

DISASTER SCIENCE: WHY TITANIC STILL MATTERS

POPULARMECHANICS.COM

APRIL 2012

+  
ACTION PLAN:  
YOUR BEST  
LAWN  
EVER  
P. 82

# Popular Mechanics

SCIENCE TECHNOLOGY AUTOMOTIVE HOME ADVENTURE

## MEGA JET

WORLD'S LARGEST  
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SPACE ROCKETS

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ALSO IN THIS ISSUE

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EXTREME OUTDOOR ADVENTURE

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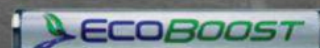


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Full-time Latin instructor and part-time stunt biker Chris "Teach" McNeil suits up for the XDL Championship Series.

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PM FEATURES VOLUME 189 NO. 4

**PopMech**  
*Apr.*

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BY CHRISTOPHER MAAG



COVER STORY

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**70 Climbing the Iron Way** Seven guys drilled a bunch of steel rungs into the face of West Virginia's Nelson Rocks. PM scales their creation, the ultimate amateur climbing course. BY JIM GORMAN

**82 The Well-Appointed Lawn** Obtaining a flawless green expanse requires careful planning. Our four-season checklist shows you how to make your lawn the envy of the neighborhood. BY EVAN ROTHMAN

On  
the  
cover

Designed by aeronautical genius Burt Rutan and backed by Microsoft co-founder Paul Allen, the world's largest plane will launch payloads—and eventually astronauts—into orbit. Due to fly in 2015, the craft is rendered here by Vladimir Shelest.

PHOTOGRAPH BY JAKE STANGEL

## New Cars

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Like all things in life, VHS tapes and even recordable CDs eventually succumb to the passage of time.

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PopMech  
diy

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**HOW TO VISIT THE SOUTH POLE** A century ago, the first person to reach the South Pole, Roald Amundsen, did it by riding on a dog sled, eating pemmican, and wearing sealskins. If you wanted to match his accomplishment today, what would you ride, eat, and wear? We asked modern-day polar explorers traveling to uncharted parts of Antarctica.

[popularmechanics.com/southpole](http://popularmechanics.com/southpole)

**BUCKET-LIST TOOLS** Some tools you use because you need to. But others you use because you want to—they're so much fun to fire up that you devise new projects just as an excuse to buy, rent, or borrow them. Find justifications for trying these 10 cool tools, but be warned: Working with them can be addictive. (And the ones that are most fun are often those with the most potential for danger—so safety first.)

[popularmechanics.com/bucketlisttools](http://popularmechanics.com/bucketlisttools)

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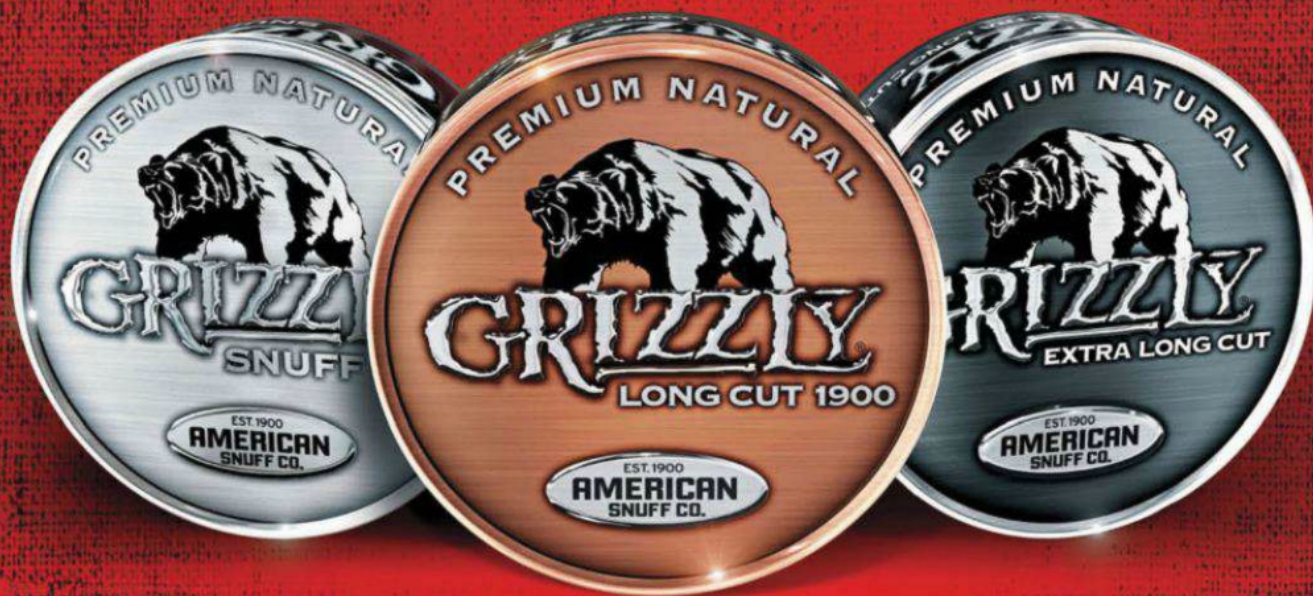
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The June 1948 issue inspired our current cover art. The vintage magazine shows a McDonnell XF-85 Goblin fighter jet deploying from a B-36 bomber. Docking glitches during testing doomed the Air Force program, but the rocket-toting jet in our new cover story seems bound for success.

story was trying to astound," he wrote. "I'd rather tear those pages out and read the rest of the magazine." We're glad we got your attention. Our story took the pervasive—and terrifying—idea that humankind could be kaput this year, which is inherently sensational, and injected it with a strong dose of actual science. Eighth-grade science teacher Shawn Kerr of Maryville, Tenn., wrote in to say that he found the story "quite entertaining" and loved sharing it with his students. Paul Frenette of Calgary, Alberta, appreciated the apocalyptic story's whimsical art treatment, which included a diorama of nuclear missiles imagined as crayons and cotton balls, calling it "simply beautiful."

#### Readers' Advice: Safe at Last

Our February Tech Watch story "Home Sweet Fortress" prompted readers to offer their own home-security advice:

- There's no joy in trimming thorny bushes. Exterior security cameras—even fake ones—would also do the trick.

WALTER JOWERS NASHVILLE, TN

- Install bright, out-of-reach, motion-detecting lights outside. Inside, upgrade

to high-quality window locks, and if you do not have a gun, keep a simple item such as a crowbar or baseball bat readily available to defend yourself.

DON MARSHALL WASHINGTON, D.C.

- If you have out-swinging doors, be sure to weld or secure the hinges so the pins cannot be removed; otherwise the door could be easily taken off from the outside.

TOM EDWARDS CLOVERDALE, OR

#### Upgrade Your Igloo

Thanks for the detailed, concise directions for building an igloo shelter ("Arctic Engineering," February). I would recommend one additional step: After construction, build a small fire inside to cause superficial melting of the interior surface. Then use a flat device to smooth the walls and allow it to refreeze to ensure a stronger structure. Prior to refreezing, you could even stick a rack of antlers in the wall for hanging items.

STEVEN KIRK DELTA, PA

#### From the Editors:

##### End of the World as We Know It

Our February cover story, "That's All Folks . . .," in which we examined 12 ways the world could potentially end in 2012, drew impassioned responses from readers. "What's with you guys, have you lost your identity?" Al Taylor of Deep River, Ontario, wrote. "If I wanted to read about doomsday predictions, I'd pick up the *National Enquirer*." Joseph Jeffries of Hialeah, Fla., agreed. "This



From our fans  
and followers

**Hello, PM readers on Facebook and Twitter! Thank you for responding to our stories. Here are some recent comments:**

*"The 10 Best Cars That Still Offer a Manual Transmission,"*  
[popularmechanics.com](http://popularmechanics.com):

Complex features appeal more to those who view cars as disposable and trade them in every few years. Many of us still prefer simple and reliable.

ANDREW RICKARD, VIA FACEBOOK

*"Is the Universe Riddled With 'Tatooine Planets'?"*  
[popularmechanics.com](http://popularmechanics.com):

So there are even more places where the Trade Federation has no presence?

MARYKE WILLEMSE, VIA FACEBOOK

A Millennium Falcon is out there somewhere . . .

NILO TIPPLER, VIA FACEBOOK

*"Live Pics From the 2012 NYC Motorcycle Show,"*

[popularmechanics.com](http://popularmechanics.com):

I keep thinking that more companies will come out with lighter bikes that offer incredible gas mileage, but I guess there is just no demand for economy yet.

BILL ROBISON, VIA FACEBOOK

What  
do you  
think?

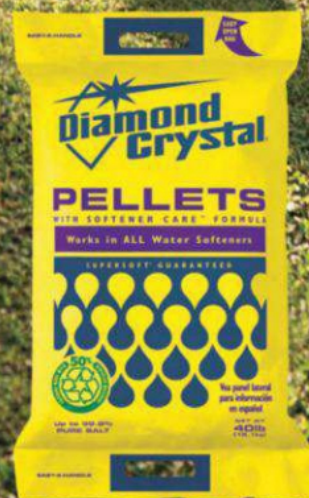
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# Tech Watch

► NASA's Earth Observing-1 satellite captured this image of a newborn island on Jan. 7. It's a healthy one-third of a mile wide in size.



## • ACTIVE PLANET

### Congratulations, It's an Isle!

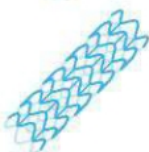


**DID YOU KNOW:** Sixty-five percent of the lava that makes it to the surface of the planet erupts not on land, but on the ocean floor.

The eruption started on Dec. 19, with local fishermen off the western coast of Yemen gaping at 90-foot-high fountains of surging basaltic magma. A few days later, when the lava had cooled, there was a new landmass in the Red Sea. Situated in the Zubair Group of islands, the newest addition to the world atlas lies at the border of the African and Arabian tectonic plates. As the plates pull apart, they cause the formation of new ocean crust. Don't start making new maps just yet: American Museum of Natural History volcanologist Jim Webster says that the odds are good the island will survive, but there's no guarantee. "It's always a competition between land formation and erosion from wind and water," he says. —ALEX HUTCHINSON



## • QUICK HITS



**The Incredible Disappearing Stent** — A woman hospitalized in Montreal with a severe lesion in a coronary artery became the first patient in North America to be treated with a "bioreabsorbable vascular scaffold." The device functions like other metal stents that prop open a partly blocked artery while delivering an anti-inflammatory drug to help restore blood flow. The difference: The bioreabsorbable stent is made of polylactide, the material used in stitches that dissolve. After about two years, the stent will have been fully metabolized and absorbed into the body. That means the healed artery may be able to fully return to normal function, flexing and dilating as blood pulses through. Made by Abbott Vascular, the bioreabsorbable stent is currently undergoing a 1000-patient global trial.

• BIOLOGICAL  
RECORD BREAKER

## Tiny Frog Makes a Big Splash

**C**hris Austin knew he had stumbled upon something big—well, important—when he found a new species of frog, *Paedophryne amauensis*, under a bed of moist leaves in Papua New Guinea. Austin, an associate professor of biological sciences at Louisiana State University, followed a chirping noise to its source, where he discovered the world's smallest vertebrate. The frog measures less than one-third of an inch, so its existence contradicts a theory that such diminutive creatures need to be immersed in water to keep their bodies from desiccating.



• ANCIENT MYSTERIES

## Rise of the Fishermen

AN ANCIENT DISCOVERY FORCES A REEXAMINATION OF MANKIND'S RELATIONSHIP WITH THE SEA.

BY STEVE ROUSSEAU



➡ **Archaeologists in East Timor** have unearthed the world's oldest fishhook, a discovery that may change scientists' understanding of ancient man's technological prowess. Australian National University archaeologist Sue O'Connor found the hook, made of shell and used at least 16,000 years ago. That predates the previous known existence of angling by 10,500 years. O'Connor's search also yielded bones of deep-sea prey such as tuna, rays, and sharks caught up to 42,000 years ago—the oldest known evidence of deep-sea fishing on the planet. The finds appear to dispel a previously held theory that Pleistocene-era humans were merely opportunists who scavenged shallow-water game. "Fishing has always been one of those things thought of as requiring complex skills," O'Connor says.

### Man vs Fish: A timeline of tools

#### SPEAR

A bone harpoon point found in central Africa next to the bones of giant catfish pegs the first spearfishing at roughly 85,000 years ago.



#### NET

Bones of deep-sea fish found at prehistoric sites suggest humans used nets—now decomposed—more than 42,000 years ago.



#### HOOK

The oldest shell hook is at least 16,000 years old—but scientist Sue O'Connor says hooks could have been used up to 23,000 years ago.



#### GORGE

Evidence of gorges—sharpened pieces of bone or stone tied to a line—dates back 12,000 years, but their use in fishing is certainly older.



#### BARBED HOOK

Hooks adapted to snag a fish's mouth emerged roughly 6000 years ago. This design has remained the same into the modern age.





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## • INFRASTRUCTURE



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## Bridge Shakes

➡ Civil engineers at the University of Nevada, Reno, injected a new level of realism into seismic testing, linking four shake tables to erect a 145-foot-long, 162-ton steel and concrete bridge in their lab. The coup de grâce: loading the tables with full-size vehicles to explore the controversial question of how heavy traffic affects bridge stability. Researchers ramped up the tremors to more than twice the strength of the 6.7 Northridge, Calif., earthquake in 1994. The initial results suggest traffic can be a blessing and a curse. The trucks' weight helped the bridge withstand smaller quakes but made it more vulnerable in larger ones. — ALEX HUTCHINSON

## • PLANETARY MATH



## Our Uneven Axis

Earth rotates every 24 hours around an imaginary line that runs through the North and South poles. Gravitational pull caused by the sun and moon, and the orbit of Earth, causes the axis to shift—but no one had ever measured it directly. To calculate this **planetary wobble**, researchers in Germany shone two lasers in opposite directions around a 13-foot-wide square loop buried 20 feet underground. The planet's rotation means that the laser has to travel slightly farther in one direction than the other; the resultant change in the beams' frequencies reveals the wobble. The results: Earth's axis drifts every 435 days by as much as 20 feet.



## • QUICK HITS



**Flu Crystal Ball** ➡ Emergency-room doctors need to know when they're about to be swamped by a flood of flu patients. According to a new study from Johns Hopkins and George Washington universities, they should turn to Google's Flu Trends tool, which tracks the frequency of 45 flu-related search queries to offer daily estimates of how bad the flu is in a given place at a given time. Previous studies have shown that Flu Trends data match up well with that collected by the Centers for Disease Control and Prevention—the problem with the CDC data is that it takes weeks to reach doctors on the front lines. The study is the first to demonstrate that Google data actually predict, with minimal lag time, when emergency-room traffic is about to rise.



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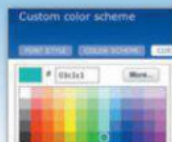
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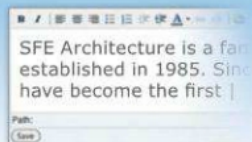
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The UAV tracks the target for the helicopter, which loiters out of visual range.

1



2

The pilot verifies the target using live video feeds from the UAV.

3

The UAV beams ballistic information—temperature, wind, and the target's range and speed—to the Apache's fire-control computer.

## 21ST-CENTURY WARFARE

### Apache Eyes

ARMY ATTACK-HELO PILOTS GAIN DIRECT CONTROL OF UAVS. **BY JOE PAPPALARDO**

→ Human-robot teamwork has reached a deadly new level. Upgrades to the AH-64D Apache Longbow helicopter have enabled its airborne pilots to control unmanned aerial vehicles and use the UAVs' video and targeting data to launch a missile attack. The Army will send the advanced Block III helos to combat aviators at Fort Riley, Kan., this spring. Combat deployment could come in 2013.



4

The attack-helicopter pilot, still safely out of sight, shoots the target.



#### Other Upgrades

NEW GEAR IS ALLOWING APACHES TO FLY, FIGHT, AND LAND MORE SAFELY.

#### ENGINE

General Electric's 701Ds offer a 5 percent power boost and more durability while running hot.

#### ROTORS

Composite rotor blades help increase the Apache's speed, climb rate, and payload.

#### TRANSMISSION

The 3400-hp drive system, with a split-torque face-gear transmission, provides more power than current Apaches.

#### LANDING GEAR

Enhanced hydraulic struts adjust to the weight load of the aircraft and help control deceleration during a touchdown.

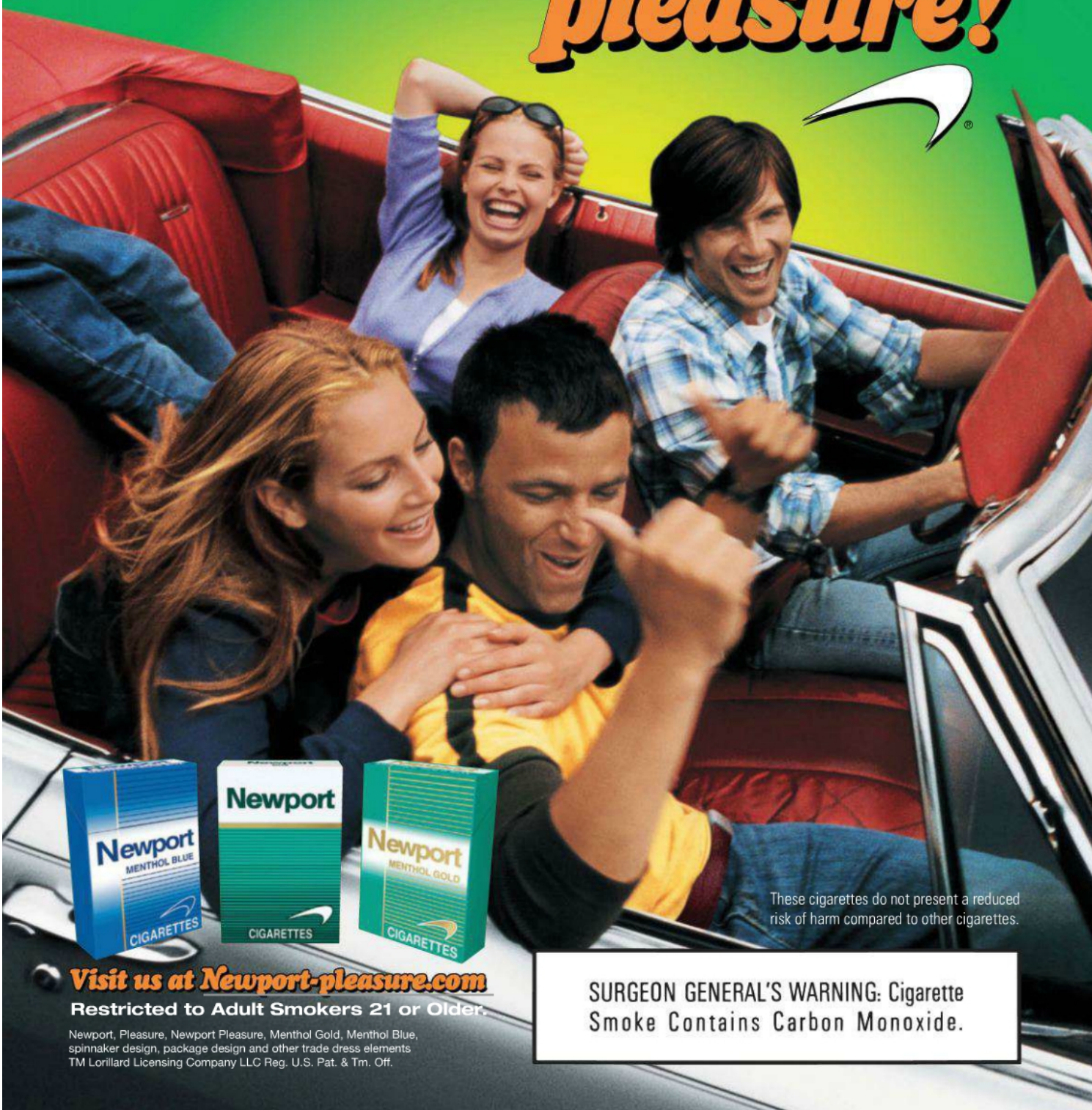
## BRAIN SCIENCE

### Seeing Addiction

**N**euroscientists are peering into the brain to understand the biological impact of addiction. Using functional magnetic resonance imaging (fMRI) of the cerebral blood flow, UCLA researchers have been able to pinpoint when smokers experience nicotine cravings. Subjects watch videos while being scanned with fMRI; by measuring which areas of the brain become active, the team can tell with 90 percent accuracy if the subjects are watching a video that shows people smoking. Researchers are also studying more modern addictions. Investigators in China compared the brains of 17 teens diagnosed with Internet addiction disorder (IAD) with those of a group of unaddicted peers. In the IAD group, they found significant abnormalities in the white matter connecting brain regions involving emotions, attention, and decision making—strikingly similar to the brain profiles of drug addicts. Such scans could ultimately help refine techniques to fight cravings, as well as identify IAD and monitor the progress of treatments. — ALEX HUTCHINSON



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## Oil Spill Anniversary

TWO YEARS AGO THIS MONTH, BP'S DEEPWATER HORIZON DRILLING RIG EXPLODED, KILLING 11 AND DUMPING 5 MILLION BARRELS OF CRUDE INTO THE GULF OF MEXICO. FEDERAL OFFICIALS VOWED IT WOULDN'T HAPPEN AGAIN, BUT HAVE THINGS CHANGED? BY ALYSON SHEPPARD

### RHETORIC

#### TIGHTEN FEDERAL OVERSIGHT

In May 2010, the Minerals Management Service (MMS) was charged with egregious ethics violations, such as accepting gifts from the oil industry. The secretary of the interior pledged to root out "bad apples."

#### ASSESS THE DAMAGE

During the crisis, White House adviser David Axelrod said, "Obviously we're dealing with the greatest environmental catastrophe of all time." Some pundits predicted the gulf would become a wasteland.

#### REFORM OFFSHORE RULES

The National Oil Spill Commission's report released in January 2011 called for "fundamental reform" to DOI regulations governing deepwater oil and gas exploration, production, and spill response.

### REALITY

To reduce conflicts of interest, the MMS was split into three separate organizations to oversee planning, inspecting, and revenue collecting. The Department of the Interior (DOI) set up an internal investigation and review unit to police its agencies.

While the offshore spill was the largest in U.S. history, it was not as catastrophic as predicted. Favorable currents and topography prevented the oil from spreading and allowed bacteria to break it down quickly. A federal study projects a reduction in bluefin populations of less than 4 percent.

Marilyn Heiman of the Pew Environment Group says the DOI has improved safety and containment requirements for drillers but has not altered its spill-response and -preparedness rules. Most new federal requirements expire in three years.

## Out of This World

For his film *John Carter*, out March 9, director Andrew Stanton had to bring alive the four-armed aliens and spectacular Martian cities Edgar R. Burroughs had imagined in his sci-fi stories. When it came to the setting, Stanton aimed for realism. "You can Google-map Mars. We said, 'Why not use the topography of Mars for as much as we can?'" he says. "So when you're seeing global views of Mars, it's absolutely accurate." Stanton's team also analyzed images from NASA's Mars rovers, which led them to the location for the live shoot: the Utah desert. "We weren't trying to directly match [Mars], but Utah has a dead sea as well," Stanton says. "They have a very similar feel."

— ERIN MCCARTHY



PHOTOGRAPH BY AP/WIDE WORLD PHOTOS (OIL SPILL)



### • QUICK HITS

**Mapping a Cosmic Unknown** ➔ Dark matter makes up about a quarter of the matter in the universe, and scientists still don't know exactly what it is—but at least now they know where it is. An international team spent five years observing 10 million galaxies using a 340-megapixel camera mounted on a telescope in Hawaii. By studying how the light from these galaxies was deflected along its route to Earth by the gravitational force exerted by clumps of invisible dark matter, the researchers were able to piece together a map of dark matter's distribution spanning more than a billion light-years. It is the first glimpse of dark matter on such a large scale.



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## • KID ROBOTICS

## Engineering + Science = Invention



There is the kind of problem kids solve in math class. And then there is the kind of problem they solve *after* math class. For the nearly 300,000 students involved in FIRST programs, founded by master inventor Dean Kamen, the latter isn't homework—it's a way of life. Each year the students spend countless hours building a path to robotic glory that culminates in a world championship in April. But given enough hardware, mentoring, and ambitious challenges, it was only a matter of time before these engineers in training began patenting inventions of their own. — JENNIFER BOGO

**PDBot (above)** The high school students on the Pink Team made bots only for the FIRST Robotics Competition—until the Rockledge, Fla., police department asked if they had one to spare. In response, the students built a robot to spec. It can climb rugged terrain, deliver a negotiation phone, launch smoke grenades, and conduct surveillance. "We were searching other police robots and were shocked by how much they cost for what they could do," says Jason Schuler, a contract engineer for NASA, a team mentor, and a FIRST alum. So the team filed a provisional patent for its PDBot and optimized the design for a kit that other teams can use to fundraise. "Instead of washing cars to raise money, they'll be building robots," Schuler says.

**Folding Forklift** Last year, the Purple Gears had to build a robot that could lift batons from the top of a 22-inch-tall dispenser for the FIRST Tech Challenge. The problem: Their robot couldn't be more than 18 inches high. "We couldn't use hydraulics—that was another restriction," says senior Ariana Keeling. So the Raleigh, N.C., high school students decided to construct a forklift that unfolds, then learned one had never been invented. On the utility patent application, they listed each team member's contributions to the design. That taught them something else valuable, says mentor John Toebes, director of patents at Cisco: "Invention is not a solo act." This spring, the Purple Gears are filing for a second utility patent for a brand-new kind of wheel.

**SMARTwheel** The Londonderry, N.H., Intentioneers had already filed three provisional patent applications by the time they created the SMARTwheel in response to a FIRST Lego League Challenge. "We found out car crashes were the No. 1 cause of death for teens, and texting was the main distraction," says 11-year-old Bryeton Evarts. "We wanted to do something to stop that." Their solution is a steering wheel cover that detects when a driver removes a hand for more than 3 seconds and emits visual and audio alerts. A data logger communicates unsafe driving behavior in real time. Writing the utility patent application was 16-year-old Tristan Evarts's favorite part: "You can conceptualize your idea, but until you have to list all its features on paper, you don't fully understand what it is."

To volunteer or to find a team or a competition near you, visit [usfirst.org](http://usfirst.org).

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Mount



Handlebar Seatpost  
Mount



Vented Helmet  
Strap



# Upgrade

The two-man Tenshi tent by Nemo Equipment is 4.4 pounds of invulnerable overnight shelter.



## To Pitch a Tough Tent:

1. Make sure you drive tent stakes as deeply into the soil as possible. Pitch stakes at contrasting angles to prevent them from pulling out.
2. Avoid buying wooden or plastic stakes. Look for a V-shaped aluminum spike with Dac in the product name. Bring extras.
3. Don't step on or into the tent with boots on. Dirt weakens the fabric.
4. The best poles thread inside the tent as much as possible. Exterior poles should fit in firm clips and metal hardware.
5. In extreme conditions, have a backup plan in case the tent fails: parachute cord to rig a shelter tarp; enough warm clothes to survive the night.

## Sleep Haven

**A**h, the smell of pine, a gurgling brook, a blazing campfire . . . and the snap of a fractured tent pole. Every spring, millions of people venture into the great outdoors. Some will tote plastic coolers and weak flashlights that won't make it through the weekend. Others will watch a tent collapse from within and they'll never sleep outside again. That's why rugged gear is important—so you enjoy the wilderness and build a can-do spirit.

Designed to withstand harsh elements, the four-season **Nemo Equipment Tenshi two-man tent (\$700)** uses Dac Featherlite poles made from flexible aluminum. A unique, breathable, waterproof fabric lets air pass through and keeps moisture out. A removable vestibule at the entrance provides 11 square feet of space for gear. When packed, the whole tent folds up tighter than a sleeping bag. Hikers have used the Tenshi in the Himalayas and Argentine Patagonia. Think it can make it through a weekend with Uncle Bob? You bet. — JOHN BRANDON



Tame the Wild With

# Indestructible Camping Gear

Don't rough it on a tenderfoot's equipment. Pack this stuff and go beyond mere survival.

BY JOHN BRANDON



## PICTURE PROTECTOR

↑ The **Pentax Optio WG-1 GPS Camera (\$350)**, a 14-megapixel, 5.9-ounce pocket cam, is waterproof to 33 feet and shockproof from 5-foot drops. It works in subfreezing temps and can withstand 220 pounds of impact force. A special underwater mode enhances color for both hi-def 720p videos and still shots. A macro mode uses five LED bulbs to illuminate a tiny object, say, a caterpillar. The camera provides 97 MB of memory but supports SD cards up to 128 GB.

## HACKER'S DELIGHT

← Based loosely on the classic Woodman's Pal machete, the **Gerber Machete Pro (\$53)** is a 16.5-inch, 18-ounce trailblazer with a large hook for clearing fallen brush. The main blade, at 10.5 inches, is made from high-carbon steel that flexes slightly. It comes with its own sharpening stone and stores nicely in its nylon sheath.



## CHILLING AT THE CAMPSITE

↑ Made in the USA and big enough to cool 85 cans, the rust-resistant **Coleman 54-Quart Stainless Steel Belted Cooler (\$220)** can endure the toughest trips and rowdiest tailgates. Rubber grips on the steel handles make it easy to load up; metal clasps lock the box, and a sloped drain lets melted ice trickle out tilt-free.

## EXTREME TERRAIN

THESE THREE DESTINATIONS DO A NUMBER ON DELICATE GEAR.

### Superior National Forest, Minn.

North of Duluth there are eight state parks over 150 miles of Lake Superior's craggy shore. The main hazard: Wind off the water can gust to 60 mph in a raging storm. Make sure your tent is tied down and anchored.

### Big Bend National Park, Texas

Southwest Texas desert dust, finer than beach sand, finds its way into visitors' eyes, mouths, tents, and sleeping bags. Its effect on electronics can be potent. Pack sealed plastic bags for cameras, phones, and food.

### Haleakala National Park, Maui, Hawaii

Hike into the crater of this active volcano and the lava-rock trails quickly begin to eat through the soles of a trekker's boots. Wear over-the-ankle boots with thick rubber soles that overlap the uppers.



## TOUGH TORCH

↓ The 5.5-inch **Pelican 1920 (\$34)** shines a bright 67-lumen beam that matches that of a bigger Maglite, but it weighs only 2.2 ounces (with AA batteries included). The aircraft-grade aluminum-alloy shell is scratch- and water-resistant. A layer of anodized plating resists corrosion. If it breaks, it's guaranteed for life. But it's small enough to get lost in the dark.



## IMPENETRABLE PACK

↓ Made in Colorado from 1000-denier double-lined nylon fabric, the minimalist **Topo Designs Klettersack (\$149)** (German for "climbing"), is puncture- and water-resistant. Straps reinforced with seatbelt webbing carry the 1100-cubic-inch main pouch, a cloth-lined compartment measuring 12 x 18 x 6 inches. Leather latch tabs give the 1-pound bag the functional style of a simple, classic rucksack.

Cordura fabric protects this durable day pack from rips and gouges.



## MAKE IT BACK ALIVE

↑ The straightforward **Bushnell D-Tour GPS (\$100)** has one main button to mark your current location and one button to help you find the way back. The 1.6-inch square screen is readable in sunlight, and the 6-ounce, 2.75 x 4.125-inch gadget resists water and damage from short drops. An accelerometer drives the directional compass, and AA batteries give the D-Tour about 24 hours of life.

## BACKWOODS GOURMET

→ The **GSI Outdoors Pinnacle Camper (\$130)** is a 17-piece set designed for camp cooking. It includes one Teflon-coated 3.17-quart pot, a 9-inch frying pan, and four sets of polypropylene plates and bowls. There's a protective sack that doubles as a washbasin. At 57.9 ounces the kit is highly portable but not as strong as polycarbonate. But dent-proof polycarbonate cooking gear usually contains BPA—a harmful chemical, especially for infants. Another drawback to this set: The pots are not intended for cooking on an open fire.



Leave no trace of chili on this plate.

STUFF  
MY KIDS  
BROKE



*When my family of six goes camping, we feel fortunate to survive the weekend. Our gear is not so lucky. It usually comes back in pieces. Coolers break, thermoses crack, and tent poles splinter. Here are a few favorite surprises after time spent on the trail.*

### Cereal Bowls

Nestled at the bottom of a box, the flimsy plastic bowls we usually take on camping trips stay safe and sound. When my 6-foot, 200-pound son leaves 14 of them scattered around a picnic area at Yellowstone? Not so much. Rugged polypropylene REI Campware bowls are now our choice.

### Pocket Camera

On one trip my second-oldest daughter dropped her Sony digital camera and broke the lens. "Slipped right out of my hands, Dad!" The next year I bought her an expensive Nikon D5000 DSLR that uses replaceable lenses and comes with a hard plastic case. She keeps a tighter grip on this one.

### Mountain Bike

I bent the frame on a mountain bike one year, and I wasn't even riding it. Note: Never try to forcibly fit a bike into the back of a packed 1994 Ford Aerostar. It's not gonna happen. Yes, I broke this one, but it only happened because the car was full of the kids' stuff. "Why didn't you use a bike rack?" my wife asked. Thanks for the belated tip, honey!



## ABUSIVE LAB TEST



- 1. DeWalt (\$20)
- 2. Husky (\$25)
- 3. Kobalt (\$25)

## Handy Little Hammer Haulers

**Y**ou can't fit the whole shop in a toolbox like DeWalt's 24-inch, Husky's 22-inch, or Kobalt's 26-inch. But for most jobs, a collection of essentials is all you need. Do interesting new features like one-touch latches and anticorrosion linings make a toolbox better? We tested three to see which ones can handle our hardware. **BY STUART DEUTSCH**

## Capacity

*Our test load included a framing hammer, a small push saw, an 18-volt drill, a 55-yard roll of duct tape, and a few other items found in any well-equipped DIY toolbox.*

**DEWALT:** The comparatively narrow, tall box was the only one that fit the drill standing up. Rated for 60 pounds, the DeWalt easily accommodated the test kit.

**HUSKY:** Short (19½-inch interior) but wide (11 inches), the box held all our test gear, plus a hammer drill—though the extra tool pushed the 44-pound weight limit.

**KOBALT:** Only this box could handle a 2-foot level and a loaded caulk gun. But the 45-pound-rated box lost its shape when the hardware tray was removed.

## Design

*With an eye on ergonomics and features that just make the toolbox easier to use, we watched blindfolded testers open, fill, shut, and carry each product.*

**DEWALT:** The box's one-touch latch could be opened with a finger and shut with a drop of the lid. A seal kept contents dry, and a rubber-lined handle ensured easy hauling.

**HUSKY:** The latch opened with one hand and closed with a satisfying click. The textured handle offered a firm grip, but the box rubbed against a leg as it was carried.

**KOBALT:** The slightly too fat handle made the box a bit unwieldy, and the dual cam latches were a chore. One plus: There's a built-in Zerust corrosion inhibitor.

## Durability

*Toolboxes make good step stools. We had a 200-pound man stand on the empty carriers, adding weights and a backpack to test them at 260 and 310 pounds.*

**DEWALT:** Even under 310 pounds of load, the box felt rigid and supportive. No visible bowing or flexing signaled solid construction and balanced weight distribution.

**HUSKY:** A reinforced lid helped distribute the load. There was no change at 200 or 260 pounds; 310 pounds produced slight bulging but not enough to break a sweat.

**KOBALT:** The box walls bowed outward during all three tests but held up under the weight. Despite the flexible sides, nothing cracked or failed.

**BOTTOM LINE** The DeWalt and Husky models took the lead with innovative, quick latches. Capacity is roughly equal between the tall DeWalt and the husky Husky. But only one could be opened empty without tipping, because of its stout dimensions: Husky wins!



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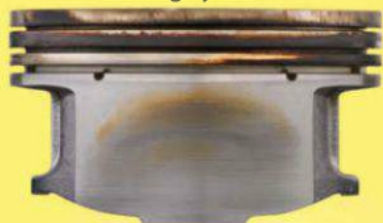


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UPGRADE

Editors'  
Picks

Consumer Electronics Show

## The Best of CES

More than 3000 companies gathered in Las Vegas for the Consumer Electronics Show. Over 20,000 products appeared, but only a few stood out. Here are the new machines you need to know about for early 2012.

### NOKIA LUMIA 900

↓ The LTE-capable, 4.3-inch-screen *Lumia 900* (\$100) is the halo device for Nokia and Windows Phone in the U.S. It shares a sleek design with the 3G Lumia 800 but has a bigger, 1840-milliamp-hour battery. It also sports a killer camera with a wide-angle 28-mm f/2.2 lens.



### MAKERBOT REPLICATOR

↑ Larger than the original MakerBot, *MakerBot Replicator* (\$1750) allows the amateur inventor to create objects roughly the size of a loaf of bread out of common manufacturing materials such as ABS or PLA plastic. Also, unlike the company's original 3D printer, the Thing-O-Matic, the Replicator has the ability to rapidly print dual-colored plastic prototypes.



### LENOVO YOGA

↑ With both a traditional desktop mode and an all-new touchscreen interface, Windows 8 represents Microsoft's first complete rethink of the desktop operating system since 1995. The *Lenovo Yoga* (\$1200) can open up as a 13-inch folding laptop. But the screen can move backward a full 360 degrees until it rests against the bottom of the computer. Then it operates as a flat tablet computer with a capacitive touchscreen.



*"When I was 4, I already  
knew what I wanted to be  
when I grew up. Faster."*

*-Ann Marie Wachel*

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# The Tech-O-Meter

→ New gadgets hit the market at such a fast pace that they can become a blur. Here we present 10 items worth focusing on, for better or worse. BY JOHN HERRMAN



UPGRADE

## 1 VIZIO THIN + LIGHT LAPTOP

In a sea of MacBook Air clones, these well-designed laptops stand out with clean lines, a matte finish, and a distinctive style. But the guts are just Ultrabook basics. (\$TBA)

## 2 ROKU STICK

This USB-size device plugs into the back of newer televisions, including Best Buy's affordable Insignia line, and instantly turns them into smart TVs with no external power source required. (less than \$100)

## 3 DISH NETWORK HOPPER

A DVR that can record every major network's prime-time lineup every night for eight days. The 2000 hours of content requires 2 TB and dubious taste. (bundled with satellite package)

## 4 GOPRO WI-FI BACPAC

GoPro makes action cams for snowboard helmets or BMX handlebars. This clip adds wrist and smartphone controls. (\$100)

## 5 OLPC XO3

A cheap tablet for the developing world from the people who made the first cheap laptop for the developing world. (\$100, est.)

## 6 GRIFFIN TWENTY

The elegantly designed Griffin Twenty device turns any Apple AirPort Express into a powered stereo system. (\$200)

## 7 POWERSKIN SPAREONE

This simple, low-tech phone runs off an AA battery. Perfect for your storm shelter, first-aid kit, or underground seed bunker. (\$50)

## 8 SHARP FREESTYLE

A small TV with wireless connectivity and batteries. Watch the game while you're tending the grill! (\$TBA)

## 9 GALAXY NOTE

At 5.3 inches this Android device is a bit too small to be a tablet and far too big to be a phone. Consolation prize: a free stylus. (\$300)

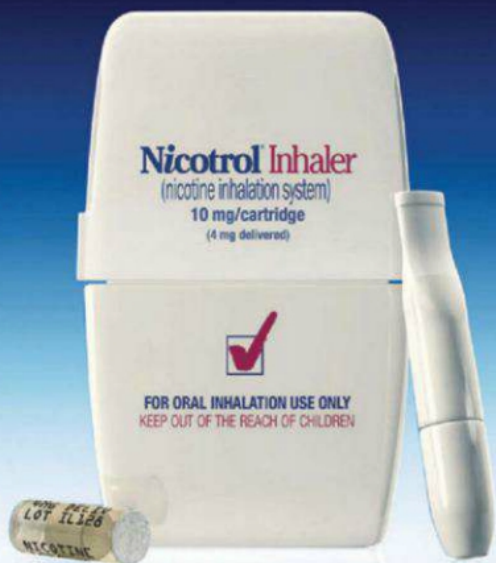
## 10 VICTORINOX USB DRIVE

It's a USB drive you can't take on a plane or into a school or maybe even to work. In a more appropriate setting—say, a forest—you might have trouble finding uses for that astounding 1 terabyte of storage. (\$TBA)

DIAGRAM BY JULIEN RIVOIRE



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Trying to quit smoking but need some help? Talk to your doctor to see if NICOTROL Inhaler—the inhaled prescription nicotine replacement therapy—may be right for you.

NICOTROL Inhaler, when used as part of a comprehensive behavioral smoking cessation program, may help you quit smoking by reducing your urge to smoke.<sup>1</sup>

For more information on NICOTROL Inhaler, visit [www.Nicotrol.com/2012](http://www.Nicotrol.com/2012)

#### Indication

NICOTROL Inhaler is indicated as an aid to smoking cessation for the relief of nicotine withdrawal symptoms. It is available only by prescription and is recommended for use as part of a comprehensive behavioral smoking cessation program.

#### Important Safety Information

Do not use the NICOTROL Inhaler if you are hypersensitive or allergic to nicotine, menthol, or to any ingredient in the product.

If you have cardiovascular, peripheral vascular, or bronchospastic diseases including asthma or chronic pulmonary disease, talk to your doctor about using the NICOTROL Inhaler. If you are under a doctor's care for any condition, you should first discuss with your doctor the potential risks of using this product.

You should stop smoking completely before using the NICOTROL Inhaler. You should not smoke or use other nicotine-containing products while under treatment with the NICOTROL Inhaler.

Because nicotine is addictive, it is possible to become dependent on the NICOTROL Inhaler. It is important to use it only for as long as needed to overcome your smoking habit. The safety of treatment with the NICOTROL Inhaler for periods longer than 6 months has not been established, and such use is not recommended.

*Please see Brief Summary of Important Risk Information for NICOTROL Inhaler on the back.*

**A special note about children and pets:** The NICOTROL Inhaler can cause serious illness or be fatal in children and pets—even in very small amounts. If a child chews on or swallows new or used NICOTROL Inhaler cartridges, immediately call a doctor or call your regional poison center.

The specific effects of the NICOTROL Inhaler treatment on fetal development and nursing infants are unknown. Therefore, pregnant and nursing smokers should be encouraged to attempt cessation using educational and behavioral interventions before using pharmacological approaches.

You are likely to experience mild irritation of the mouth or throat, or cough when you first use the NICOTROL Inhaler. In clinical trials, the frequency of mouth or throat irritation, or coughing declined with continued use. The most common nicotine-related side effect was upset stomach. Other nicotine-related side effects were nausea, diarrhea, and hiccup. Smoking-related side effects included chest discomfort, bronchitis, and high blood pressure.

It is important to tell your doctor about any other medications you may be taking because they may need dosage adjustment.

*You are encouraged to report negative side effects of prescription drugs to the FDA. Visit [www.fda.gov/medwatch](http://www.fda.gov/medwatch), or call 1-800-FDA-1088.*

1. Nicotrol Inhaler [prescribing information]. New York, NY: Pfizer Inc; 2008.





10 mg per cartridge (4 mg delivered)

## Important Facts About NICOTROL Inhaler

This information does not take the place of talking to your doctor about your medical condition or your treatment.

### What is the most important information I should know about NICOTROL Inhaler?

Do not use NICOTROL Inhaler if you are hypersensitive or allergic to nicotine or to menthol.

Because you are already addicted to the nicotine in cigarettes, it is possible to stay dependent on the lower dose of nicotine found in the NICOTROL Inhaler. It is important to use the Inhaler for only as long as directed by your doctor to overcome your nicotine addiction and smoking habit.

People who use NICOTROL Inhaler with a comprehensive behavioral smoking cessation program are more successful in quitting smoking. This program can include support groups, counseling or specific behavior change techniques.

Remember:

- **Do not use more than 16 cartridges each day unless directed to do so by your doctor**
- **Do not use NICOTROL Inhaler longer than 6 months**

**Keep out of reach of children and pets.** The NICOTROL Inhaler can cause serious illness in children and pets—even in very small amounts. If a child chews on or swallows NICOTROL Inhaler cartridges, call a doctor or Poison Control Center.

NICOTROL Inhaler may cause side effects. Many people experience mild irritation of the mouth or throat and cough when they first use the NICOTROL Inhaler. Most people get used to these effects in a short time. Stomach upset may also occur. Nicotine from any source can be toxic and addictive.

**If you are pregnant or breast-feeding, only use this medicine on the advice of your health care provider.** Smoking can seriously harm your child. Try to stop smoking without using any nicotine replacement medicine. This medicine is believed to be safer than smoking. However, the risks to your child from this medicine are not fully known.

### What should I know before I start using NICOTROL Inhaler?

**Commit yourself – NO SMOKING!** For the NICOTROL Inhaler to help, you must be firmly committed to quitting! **Stop smoking** as soon as you **start using the Inhaler**. Do not smoke or use any other tobacco products at any time while using the NICOTROL Inhaler.

**Nicotine overdose can occur.** If symptoms of overdose occur, call a doctor or Poison Control Center immediately. Overdose symptoms include: bad headaches, dizziness, upset stomach, drooling, vomiting, diarrhea, cold sweat, blurred vision, hearing difficulties, mental confusion, weakness and fainting.

### What is NICOTROL Inhaler?

**NICOTROL Inhaler helps you quit smoking by reducing your urge to smoke.** Success in quitting with nicotine replacement therapy (such as NICOTROL Inhaler) usually involves behavior change. Your doctor may adjust the number

of Inhaler cartridges during the first few weeks. As your body adjusts to not smoking, your doctor will either tell you to stop using the Inhaler or slowly reduce the dose.

### What is a nicotine replacement therapy?

Nicotine replacement products are one type of smoking cessation product. Designed to wean your body off cigarettes, they supply you with nicotine in controlled amounts while sparing you from other chemicals found in tobacco products.

### What should I tell my healthcare provider before using NICOTROL Inhaler?

Tell your doctor if you have:

- heart problems (recent heart attack, irregular heartbeat, severe or worsening heart pain)
- allergies to drugs
- high blood pressure
- diabetes requiring insulin
- stomach ulcers
- kidney or liver disease
- overactive thyroid
- wheezing or asthma

**Tell your doctor about any medicines you are taking—the dosages may need to be changed. Check with your doctor before taking any new medicine while using NICOTROL Inhaler.**

### What are the possible side effects of NICOTROL Inhaler?

You may experience mild irritation of the mouth or throat and cough when you first use the NICOTROL Inhaler. You should get used to these effects in a short time. Stomach upset may also occur.

Tell your doctor if you have any side effect that bothers you or that does not go away. Call your doctor for medical advice about side effects.

### How do I use NICOTROL Inhaler?

Follow doctor's directions. Stop smoking completely during the NICOTROL Inhaler treatment program. See full Patient Information for additional details.

### How should I store NICOTROL Inhaler?

- Store cartridges at room temperature, not to exceed 77° F (25° C)
- If you keep cartridges in car, be careful: interiors heat up quickly
- Protect from light
- Clean mouthpiece regularly with soap and water

**You are encouraged to report negative side effects of prescription drugs to the FDA. Visit [www.fda.gov/medwatch](http://www.fda.gov/medwatch), or call 1-800-FDA-1088.**

Need more information? Ask your doctor or healthcare provider. Talk to your pharmacist. Visit to [www.NICOTROL.com](http://www.NICOTROL.com) or call 1-800-222-7200.

**References:** 1. Nicotrol Inhaler [prescribing information]. New York, NY: Pfizer Inc; 2008. 2. FDA 101: Smoking cessation products. U.S. Food and Drug Administration Web site. <http://www.fda.gov/ForConsumers/ConsumerUpdates/ucm198176.htm>. Accessed November 14, 2011.

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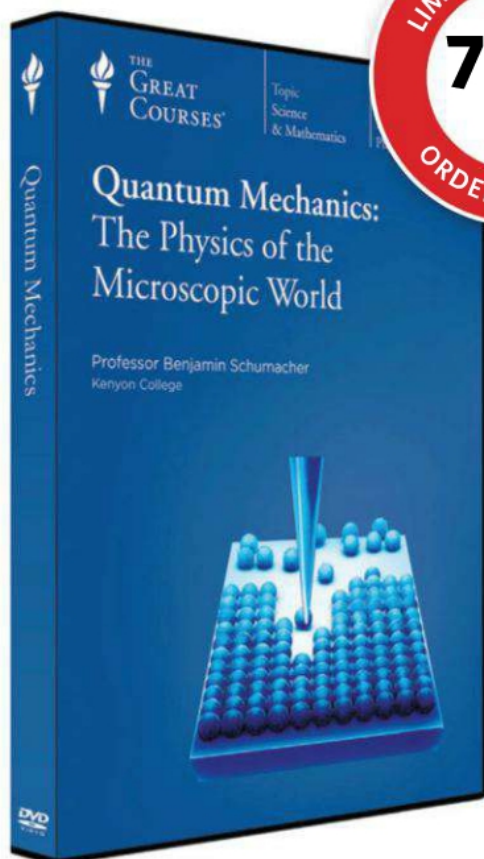
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AUTO SHOW

2012

## New Cars

Ed Welburn, General Motors' vice president of global design, warms up the crowd as he prepares to unveil the Cadillac ATS.

SHOW OF  
FORCE

**S**o we may still be mired in the aftereffects of a nasty recession, but there was little malaise at the recent North American International Auto Show in Detroit. After three years of scaling back by the big automakers, the trickle of new-model debuts has turned into a high-pressure pipeline of product. The 2012 show left visitors feeling that Motor City is in the innovation business again.

Auto execs from domestic and import brands alike exuded a sense of confidence about the future. That sense was reinforced by a show floor populated with a rich array of introductions—some 40 in all, from dream concepts to production cars, from the latest eco-oriented models to high-performance exotics.

The net was an expo reminiscent of the show's pre-recession glory years, a collection of temptations that provoked major buzz and attracted the best attendance since 2005. We attended, and here are some of our favorite vehicles from the show. —TONY SWAN

CADILLAC  
ATS

It looks like a smaller, smoother version of the CTS, but this compact Caddy is new, down to its rear-drive Alpha platform. The ATS will be offered with three engines (including a 318-hp V-6) and optional AWD, and it earned some racing cred on Germany's Nürburgring track during development. On sale by summer's end, the car seeks to challenge BMW's pace-setting 3 Series sedans. A familiar song? This time Cadillac may be singing on key.



## New Cars AUTO SHOW

**Ford Fusion**

Ford's lineup of striking designs gets yet another head-turner with the introduction of the redesigned Fusion sedan at the Detroit show. Besides a slick new skin, the makeover includes three powertrain choices—a turbocharged gas motor, a hybrid, and a plug-in hybrid—plus manual and automatic transmissions, all-wheel drive, and engine stop/start. It's due in showrooms in late summer as a 2013 model.

**Volkswagen E-Bugster Concept**

What would the latest Beetle look like if VW chopped the top another 2.8 inches? Here's the answer. The Bugster's electric powertrain will debut in the Golf Blue-e-Motion in late 2013. Key elements: a 114-hp electric motor and a 695-pound lithium-ion battery pack stowed under the rear seat. VW predicts a range of more than 100 miles.

**Chrysler 700C**

"Style" and "minivan" are uneasy allies in a single sentence, but Chrysler's 700C concept is the latest attempt to add visual sizzle to the versatile family hauler via a number of uninhibited design departures from the standard minivan shape. Presented strictly as a design study, Chrysler built it to gauge public response at a number of auto shows.

**DODGE DART**

If you've seen Alfa Romeo's Giulietta, this new compact sedan may look a little tame by comparison. The Alfa allusion isn't random; Alfa, like Chrysler and Dodge, is now part of Fiat. The Dart is the first Dodge to use a version of the Giulietta's front-drive platform, which should translate as respectable driving dynamics. There will be three available Chrysler four-cylinder engines, including a 184-hp turbo. And if the exterior is too conservative, Mopar is standing by with high-octane visual tuneups.







### LEXUS LF-LC

The 2+2 LF-LC concept coupe was one of the most luxurious pieces of eye candy to premiere in Detroit. It suggests a more affordable version of the \$350,000 LFA supercar—front engine with rear-wheel drive—but where the LFA employs a V-10 engine, the LF-LC uses a gas-electric powertrain. There were rumors that the LF-LC might be a competitor with the Porsche 911, but unfortunately, production is not in the cards.



### Toyota NS4 Concept

A possible preview of the 2015 Camry, this slick four-seat concept was created at a Toyota studio in Japan and is based on the European Avensis sedan. Though specifics were limited, the NS4 showcases a new plug-in version of Toyota's Hybrid Synergy Drive. The shape could turn the bland Camry into an object of desire, but some Toyota execs hinted that the NS4 might also be the next Prius.



### Chevrolet Code 130R Concept

A next-gen muscle car for young drivers, the 130R uses hardware already in production—the same rear-drive Alpha platform as the Cadillac ATS, and a 1.4-liter turbo four-cylinder with GM's eAssist hybrid technology. Reviews on the design were mixed at best, so expect a slightly softer look if it makes it to market.



### Acura NSX Concept

Acura's supercar died of neglect in 2005, but it may be ready for a resurrection. This wicked concept is supposedly headed for production, perhaps by 2015. Its rear wheels would be driven by a V-6 engine, and each front wheel would have its own electric motor.



### Chevrolet Miray Concept

Chevy uses the term sculptural velocity in connection with this snazzy little roadster concept, a sci-fi orchestration of carbon fiber and fiberglass. The two-seater features an interesting gasoline-electric hybrid system that allows the driver to select either front or rear drive. Miray means "future" in Korea, where the roadster made its first appearance. However, the Miray's future does not include production.

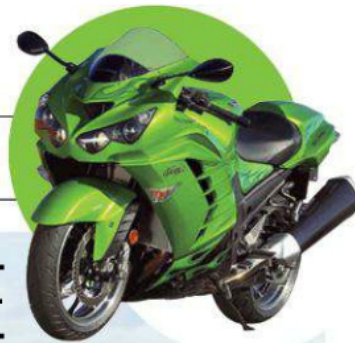


## New Cars TEST DRIVES

## MEAN, GREEN SPEED MACHINE

The new Kawasaki Ninja ZX-14R is a rarity—a motorcycle that outpowers and outruns the ferocious Suzuki Hayabusa. For 2012, the green brand enlarged the ZX's aluminum four-cylinder to 1.44 liters and increased horsepower to around 200, which trumps cars that weigh five times as much. Thanks to frame upgrades, stiffer suspension, and the addition of two power modes and three traction-control settings (which can be disabled), the ZX-14R proved itself quite the two-wheeled land missile at Las Vegas Motor Speedway's dragstrip, where the

electronic aids made those oodles of oomph virtually idiot-proof. Under ideal conditions, it should clear a quarter-mile in under 10 seconds. And yet a street ride also proved this is one velvety-smooth pussycat when unprovoked; during a stretch through Nevada's Valley of Fire State Park, our ZX-14R loped up hills at 27 mph while idling in sixth gear. But it seems Kawasaki is more concerned about going quick than stopping in a hurry—the bike has a top speed of 186 mph, yet antilock brakes aren't available. — BASEM WASEF



## SCRAPPY SCION

The Scion FR-S is a great reminder that big thrills don't have to come in expensive packages. Thanks to a partnership with Subaru, the Scion shares its basic hardware—rear-wheel drive and a 200-hp flat-four engine—with the Subaru BRZ. The pair differ slightly in styling and suspension tuning. We've driven the Subaru and it's fantastic, but we were initially skeptical about the Scion. Its tires are, after all, the same ones used on the Toyota Prius. They're constructed for low rolling resistance, not high grip, which seems at odds with the Scion's mission. But in the case of the FR-S, high-performance figures are not the goal. Sure, it's quick enough, but the car's response and feel are what separate it from other coupes. The chassis has remarkable balance, and it changes direction with uncanny accuracy and verve. Some will desire more engine power, but the beauty of the FR-S is that it doesn't have to be on a racetrack for the driver to enjoy that mechanical connection.

— ANDREW ENGLISH

2012  
Kawasaki Ninja ZX-14R  
\$14,699

2013  
Scion FR-S  
\$25,000 (est.)



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**1907** The first year the Detroit Auto Show was held. Except for a 10-year pause beginning in 1943, the event, now the North American International Auto Show, has run annually.



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## New Cars TEST DRIVES

## 2 BRITISH BENZES

It seems like a month doesn't go by without a new AMG Mercedes-Benz. Those three letters denote the highest-performing models that come stuffed with muscular V-8s and stiffened suspensions. They're pricey but delicious, further proof that excess still exists. Here are the two latest.



## THE OPEN-AIR MONSTER

**T**he 2012 SLK55 AMG is the third SLK from the company's in-house tuner, and it's an exhilarating place to plant your keister. The 5.5-liter V-8 makes 415 hp, and at full throttle produces one of the most joyful and distinctive noises on the road. For all its fury, this SLK can be frugal; by deactivating cylinders, it gets up to 30 mpg on the highway. The suspension mutes vicious bumps but delivers extremely communicative road feel and steering feedback. The car does occasionally skip over midcorner jolts—a legacy, perhaps, of the stiff antiroll bars. A cozy interior is well-appointed with high-tech details such as an electrochromatic glass roof panel you can darken as desired. Or for a closer connection with the outdoors, lower the folding metal roof. Slick and fast, the SLK55 does not disappoint.

— BEN WOJDYLA

2012  
Mercedes-Benz SLK55 AMG  
\$68,3752012  
Mercedes-Benz ML63 AMG  
\$95,865

## THE SPORTIER UTILITY VEHICLE

**W**ith 518 hp, the ML63 should feel like a junkyard dog pulling at its tether. But for this new version, Mercedes ditched the naturally aspirated 6.2-liter V-8—a delightful, thinly disguised race motor—for a slightly more efficient 5.5-liter V-8 that's boosted by a pair of turbos. Leave the suspension on the softest setting and this AMG-modified super sport ute is as tame as a Taurus. You sit coddled in beautifully stitched leather and surrounded by warm wood tones, a fitting interior for the 95 grand base price. Start the fun by selecting the sportiest modes for the suspension and

seven-speed automatic, then bury the throttle. The twin-turbo V-8 bellows deeply and barks loudly at each upshift as the ML hustles to 60 mph in just 4.6 seconds. Staying within the law is nearly impossible—especially if you opt for the \$6050 power package, which bumps horsepower to 550 and torque to 560. Given room, the ML63 will huff to 174 mph, and the sensation at extra-legal speeds is quite serene. With its more than 2 tons of weight, no one will mistake the ML63 for a sport sedan. But the air springs and active antiroll bars give the chassis astonishing grip and poise given its high center of gravity. — BEN STEWART



AUTO

INTEL

**6** By the end of the year, Mercedes will add a diesel engine to the GLK sport ute, bringing the number of Mercedes diesel-powered U.S. models to six, the highest in the industry.

## THE HAMMER

In 1986, AMG, an independent tuner shop, offered a modified Mercedes E-Class nicknamed the Hammer. It was the world's fastest sedan and felt factory-made. Soon after, AMG and Mercedes got cozy, and in 1999, Mercedes bought 51 percent of AMG.



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## New Cars ROUNDUP

## SIX-SCOOTERS

Once pigeonholed as two-wheeled transport for the *dolce vita* set, scooters are enjoying a renaissance in the U.S. thanks to spiraling fuel costs and recession-friendly prices. No longer just coffee-shop cruisers, scooters can also be fuel-efficient commuters and even peg-scraping canyon carvers. These six exemplify just how diverse the genre has become. *BY BASEM WASEF*

## O STYLISH HOT ROD

Vespa's basic scooter design has barely changed for the better part of seven decades, but beneath the GTS 300 Super's familiar exterior lurks a gutsy 278-cc single that can propel it to 80 mph. Although it sports an elegant Italian silhouette, torquey thrust makes this a surprisingly entertaining urban sled. And while this Vespa's a relative gas guzzler in a segment where triple-digit fuel-economy numbers aren't uncommon, the GTS 300 Super's estimated fuel economy of 65 to 70 mpg still makes it a Prius beater for the price of a used Civic.



Yamaha Zuma 50F  
\$2540

## O SHOESTRING RUNABOUT

Yamaha has sold more than 79,000 Zuma scooters since 1989, and this lithe ride receives a series of 21st-century upgrades for 2012. The smoky two-stroke engine has been ditched for a fuel-injected, liquid-cooled 49-cc four-stroke. Fuel economy is claimed to be an exceptional 132 mpg, though the Yamaha also takes a while to creep to its top speed of around 40 mph. At least there's a handy cup holder for the parched, and an available Garmin nav system that displays local speed limits—not that you'll need to worry about those.

Vespa GTS 300 Super  
\$6199





BMW C 650 GT  
\$10,000 (est.)

## ○ HIGH ROLLER

**B**MW's first foray into the U.S. scooter market is a bold one. When the all-new C 600 Sport and C 650 GT reach American shores this fall, they'll introduce a Teutonic distraction in a realm typically dominated by Japanese brands. Although both models are powered by a 647-cc twin-cylinder mill that produces a potent 60 hp bundled with standard ABS, the GT's bigger and lower saddle is more accommodating for all-day rides. With its floorboards, adjustable passenger backrest, and electrically adjustable windscreens, the GT is a viable alternative to smaller-engined touring motorcycles.

Honda PCX  
\$3399

## ○ EV WITH APP APPEAL

Brooklyn-based Evolve Motorcycles scored Internet buzz with its battery-powered Tron Light Cycle replica, but that \$55,000 ride is miles away from the company's bread-and-butter offerings. The Helium is the most affordable of the EV scooter lineup, and its LiFe PO4 battery yields a 40-mph top speed and 45 miles of range. Crave more distance? A \$1500 model upgrade boosts that figure to roughly 110 miles. The Helium's styling might be textbook internal combustion (and a bit on the bland side), but a smartphone app with GPS and a charging-station locator gives this pint-size ride a futuristic twist.

Evolve Helium  
\$2900

## ○ SMOOTH OPERATOR

If 50 ccs are too wimpy and 150 ccs too much, Honda's 125-cc PCX is the solution. Big, 14-inch wheels reduce the twitchy handling inherent in scooters, and linked rear-to-front brakes make quick stops an easy task. Taller riders may find the PCX's proportions a bit tight, but there's plenty of space for storage—a large underseat area swallows full-face helmets whole. Its gas tank holds only 1.6 gallons, but an estimated fuel-economy rating of 110 mpg should keep the fill-ups infrequent.

Boxx  
\$3995

## ○ DESIGNER'S DREAM

**T**his avant-garde electric scooter might look like a space heater on wheels, but its spare design packs plenty of innovations. Built using a weld-free, monolithic aluminum construction method that brings total weight to a mere 120 pounds, the Boxx saves space by packaging small electric motors in the wheels. Thus, this odd duck is also two-wheel drive and can move along at 30 mph for around 20 miles (or 40 miles in Eco mode). An additional lithium-polymer battery (\$599) doubles the range. The Boxx is expected to hit the market in the fourth quarter of 2012.

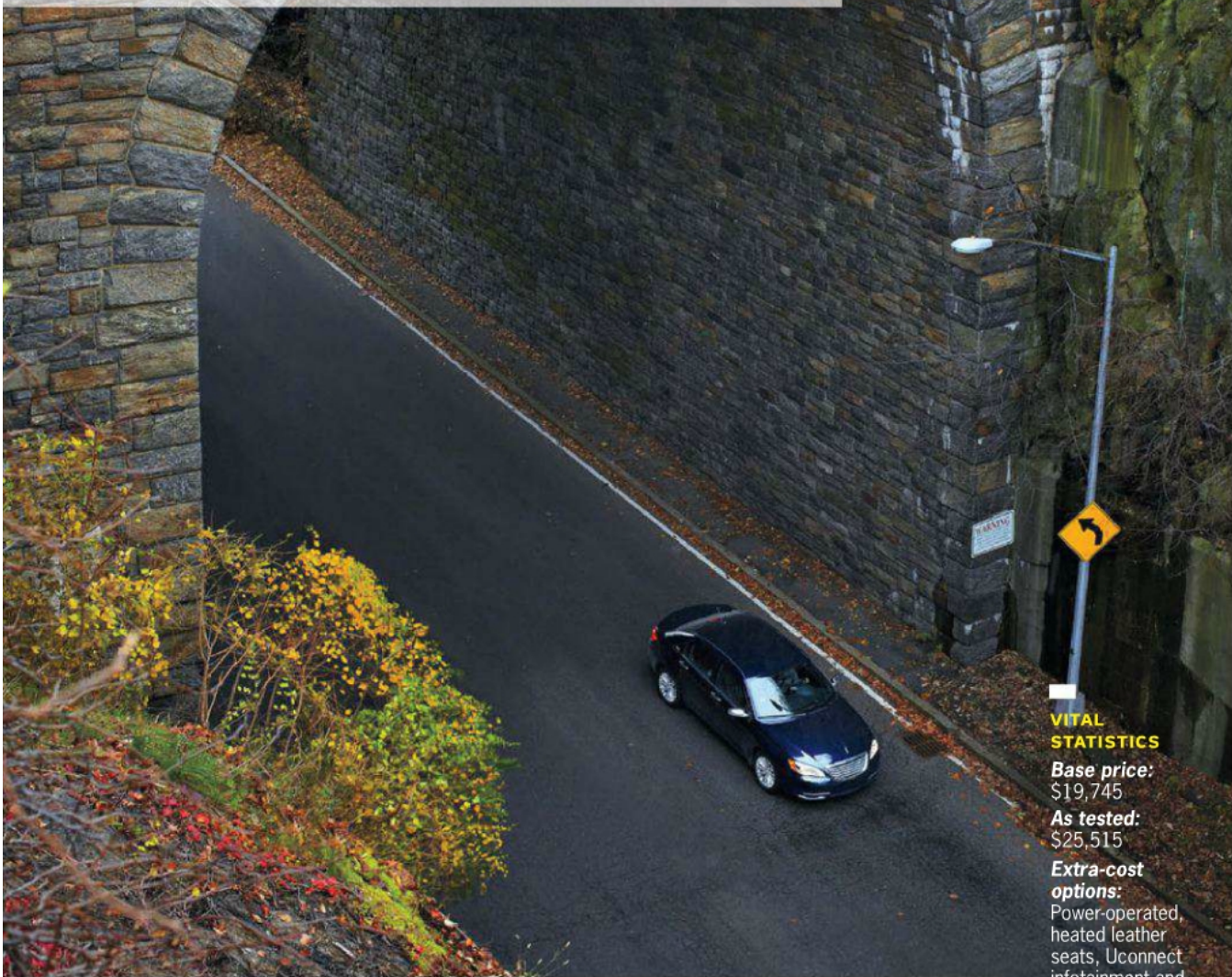




## Long-Term Test Cars

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PM TEST  
DRIVEN



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**As tested:**  
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options:**

Power-operated, heated leather seats, Uconnect infotainment and navigation system, auto HVAC, 18-inch wheels and tires

**Drivetrain:**  
2.4-liter I-4, 6A, FWD

**Engine  
performance:**  
173 hp, 166 lb-ft of torque

**EPA fuel  
economy:**  
20 city/  
31 highway

## 2012 Chrysler 200

FIRST report

The 200 is a facelifted version of the Sebring, a model name that joins Neon, Stratus, and countless others in Chrysler's trash heap. With the name change comes a handsome new interior—and a smoothing of many of the Sebring's rough edges. Now the 200 is a respectable choice in the popular midsize sedan class. For our loaded Limited model, we skipped the 3.6-liter V-6 in favor of the thrifter 2.4-liter four-cylinder and silky six-speed automatic. At \$25,515,

our 200 is packed with enough goodies that it feels like a more expensive car. One editor remarked that the 200 is like a Mercedes C-Class for \$15,000 less. A few minor issues have surfaced, however, like a surprising sensitivity to potholes and the uncomfortably sharp lip of the trunk edge. But on a snowy trip to Toronto, the 200 safely tackled the slick highways thanks in part to the standard stability-control system. — HARRY SAWYERS



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# **Cub Cadet**

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**DRIVERS NOTEBOOK**

• Lately we've been hearing a little clunk in the rear axle when we fire up the engine in the morning. We'll check that at the next service.

• Rear visibility isn't so hot, which makes the reverse camera critical—especially for families with small children roaming the driveway.

**DATA SO FAR**

**As tested:** \$37,150  
**Previous report:** See 01/12  
**Miles driven:** 7326  
**Miles since last report:** 7326

**Fuel economy:**

Average—20.9 mpg  
 Worst—16.9 mpg  
 Best—29.0 mpg  
**Maintenance/repair since last report:** \$0  
**Overall:** \$0

**2012 Sorento SX AWD****SECOND report**

**Over the past four months** our Kia Sorento has proved a versatile family hauler and daily commuter. In our August 2011 three-row-crossover comparison test, we called the Kia “rambunctious.” And indeed, it has been more fun than any vehicle optimized to transport muddy, pint-size soccer players has a right to be. That’s partly because of its modest dimensions and relatively light weight. (The penalty for that sprightliness is a tight third-row seat.) The interior appointments are hardly flashy—this is one of the more affordable SUVs—but we’ve found the cabin layout pleasantly unfussy.

Probably the biggest reason people buy into the SUV segment is AWD winter-weather capability. After a recent snowstorm, the Kia’s alert AWD system handled steep grades and snowy country roads with a confidence that bordered on cockiness. Check off another box for this smart, high-value crossover. — JIM MEIGS

**2011 Jeep Grand Cherokee Overland**

**Every vehicle with a distinctive personality** needs a nickname. I dubbed the Jeep Shrek. It’s big and green, and it can summon great power. After stopping for a sunset photo on the shoulder of the Ohio Turnpike, the Grand Cherokee effortlessly merged back into swift traffic from a dead stop (thank you, 290-hp V-6). But it’s also a gentle giant—over a year of testing, this ute has been surprisingly refined and quiet, not to mention a skilled off-roader. All of PM’s test drivers praise the adaptive cruise control (it automatically keeps pace with the car in front of you) and lane-change aid—a yellow triangle that lights up in the side-mounted mirrors to indicate when a vehicle is beside you. These safety features, the cushy interior, the unfailingly stable ride, and the symphonic sound system made a New York-to-Detroit road trip seem half as long as it was. As the Jeep leaves our long-term fleet, we can’t wait for Shrek II. — JOE BARGMANN

**FINAL report****DRIVERS NOTEBOOK**

• Skidded on wet road (but regained grip fast) when accelerating into a turn in Sport mode, which raises the threshold for stability-control intervention.  
 • Nav system died at 19,000 miles; software update by dealer not only revived it, but also improved user interface.

**END DATA**

**As tested:** \$45,480  
**Previous reports:** See 06/11, 09/11, 01/12

**Miles driven:**

19,646  
**Miles since last report:** 8867

**Fuel economy:**  
 Average—18.0 mpg

Worst—14.0 mpg  
 Best—19.7 mpg

**Maintenance/repair since last report:** \$62  
**Overall:** \$93



A photograph of Misty R., an Order Processing Manager at Grant, MI, and a USPS carrier in a warehouse. Misty is wearing a red polo shirt and is standing behind a wooden workbench. The carrier is wearing a light blue short-sleeved button-down shirt with a USPS patch and is holding a Priority Mail box. The workbench has various shipping supplies like bubble wrap, tape, and a Priority Mail box. The background is filled with shelves of cardboard boxes.

**MISTY R.**  
ORDER  
PROCESSING  
MANAGER  
GRANT, MI

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# The Premier Pioneering Hybrid

> BY JAY LENO

> PHOTOGRAPHS BY JOHN LAMM



JAY'S OWEN MAGNETIC WAS AHEAD OF ITS TIME, WHICH ULTIMATELY PROVED ITS UNDOING.



The control mechanism on Jay's 1916 Owen Magnetic hybrid was so complicated that a placard warned operators to take the vehicle to the factory for repairs.

# P

**PEOPLE THINK HYBRIDS ARE SOMETHING NEW**, but they've been around since the beginning of the automobile. Ferdinand Porsche built the Lohner-Porsche series hybrid car back in 1901. It used a gas engine to spin a generator that fed electricity to in-wheel motors. In 1917, the Woods Motor Vehicle Company of Chicago offered the Woods Dual Power, a series hybrid that could motor along—at speeds of less than 15 mph—solely on battery power. But I think the 1916 Owen Magnetic might be the most interesting early hybrid of them all.

The Owen Magnetic's technological leap was its electromagnetic transmission. Invented by the wonderfully named Justus B. Entz, an electrical engineer from New York who once worked with Thomas Edison, the electromagnetic transmission compactly housed both a 24-volt generator and an electric traction motor. The crankshaft of a 75-hp gas engine was attached to the generator, which sent juice to the traction motor, which in turn powered the rear wheels. There was no mechanical connection between the engine and the drivetrain.

One could argue that in 1916 hybrids made even more sense than they do today because early manual transmissions were such a bear to operate. Most cars of the era had straight-cut gears and heavy clutches. If you were a man or a woman with a bad leg, or you simply weren't able to drive, shift, and double-clutch at the same time, the Owen Magnetic was the perfect vehicle, since it has no clutch or gear shifter. To go faster, you press on the gas and then move a steering-wheel-mounted lever along six speed detents. As you accelerate, the engine speed increases, and that in turn speeds up the generator, enhancing power. Each successive lever position increases the intensity of the motor's



magnetic field and torque. Compared with operating most early cars, driving the Owen Magnetic is a breeze.

The car's other advantage was its electric brake. There's a cockpit lever that turns the traction motor—the one that drives the rear wheels—into a generator. So when it's time to slow down, you move the lever, and the resistance provided by the motor slows the car and charges the batteries—the same kind of regenerative mode that's found in today's hybrids. A lot of my old cars, which weigh between 3000 and 4000 pounds, have only rear brakes. Consequently, those brakes produce a lot of heat. When you go down a long hill, you can smell 'em starting to burn up, and they quickly fade. And if an early car's brakes get

wet, oh boy, you're in for a panic. But with the Owen Magnetic, you rarely have to get on the brakes unless you need to stop completely, like at a stop sign. If you're going 35 to 40 mph, you engage "regen" and you coast, or free-wheel. As soon as you hit 25 mph, you feel the transmission go *eeehhhrrr!* And the car slows right down to 3 or 4 mph. Plus, you can watch gauges that show the batteries charging.

My Owen Magnetic was originally sold straight from the floor of the 1916 New York Automobile Show and shipped to the buyer's home in Norway. He must have forgotten that there weren't many roads in Norway in 1916. That's probably why my car has less than 9000 miles on it.

I'm not sure when the car made it back to America, but it was probably in the 1970s. I found it right here in Los Angeles. Whatever you're looking for, you can find it within 50 miles of L.A. During World War I, and even more so during World War II, plenty of defense contractors were on the West Coast—Lockheed, Boeing, Douglas, and many more. Engineers and other technically

minded people were drawn here. With the great climate, cars didn't rust and people didn't throw anything away. A lot of the interesting cars and stuff just stayed in the area.

So why did the Owen Magnetic company fail in 1922, after producing just 700 cars?

The ads called it the car of a thousand speeds. But as is sometimes the case, being better isn't always enough. The car had to be competitively priced. A 1917 Ford Model T cost \$360; Cadillacs ran about two grand. An Owen Magnetic started at \$3700 and went up from there.

Another problem was the complicated relay-and-wiring shift mechanism. It's mounted under the hood alongside the steering column. I haven't opened mine up because it seems to work fine. And, quite frankly, I'm frightened to poke around in there. A plate on it says, "If something goes wrong, do not attempt to work on this yourself. Send it back to the factory." Who would want a car that a blacksmith couldn't fix?

In that era, most people didn't care that much about new technology. It's like the full hybrids today. They're still a hard sell because they cost more than other cars in their class. You can get better mileage, but that initial cost penalty keeps many people from buying them.

With cars, simpler and cheaper parts are often better. When the Mustang was developed, Ford considered a more expensive independent rear suspension than the solid axle the car came with. As legend has it, Ford executive Lee Iacocca said, "Americans don't give a crap about that. Make it inexpensive; make it look sexy. Don't put something in it they can't see."

Companies that don't make it in the car business usually fail because they try to sell a product that's too good or they over-engineer it and put in more than people want or need.

Sadly, that's what happened with the Owen Magnetic.

**PM**

*THE ADS CALLED IT THE CAR OF A THOUSAND SPEEDS.  
BUT AS IS SOMETIMES THE CASE, BEING BETTER  
ISN'T ALWAYS ENOUGH.*



Left: The Owen Magnetic should be awarded a prize for best logo ever. Above: The lever that changes the car's speed is located on its own ring in the center of the steering wheel.



## We Need to Dream Big Again

> BY GLENN HARLAN REYNOLDS  
> ILLUSTRATION BY MATTHEW J. LAZNICKA

SCIENCE FICTION  
USED TO BE ABOUT  
BOLD ENGINEERING.  
SO WAS AMERICA.

One of today's best SF authors is Neal Stephenson, whose books include *Cryptonomicon* and *The Diamond Age*. In a recent article in the *World Policy Journal*, he writes that during science fiction's so-called golden age—roughly the late 1930s to the late 1960s—the stories being published were about big things and big breakthroughs: moon rockets, Mars bases, robots, and teleportation. Perhaps by coincidence, those were times when the United States was actually doing big things and making big breakthroughs. Now, writes Stephenson, “[s]peaking broadly, the techno-optimism of the Golden Age of SF has given way to fiction written in a darker, more skeptical, and ambiguous tone.”

Those stories can be good—some credit Stephenson's own 1992 book, *Snow Crash*, with anticipating the social media revolution—but are they good for us? Or have we been focusing our imagination and efforts on things that are amusing but unimportant? Stephenson recently told *The New York Times*, “We can't Facebook our way out of the current economic status quo.” He is calling for new ways to expand civilization, not new forums for gossip.

I called Stephenson and asked him to elaborate. “There was some moment in the late '60s and '70s when people thought we had enough tech,” he says. “Technology was too dangerous, and people became reflexively skeptical of new ideas. If you stay that way for a couple of decades, it can come back to bite you. There's also a less obvious danger, which is that if science and technology stop wowing

### THE FUTURE ISN'T WHAT IT USED TO BE.

And neither is science fiction. While books about space exploration and robots once inspired young people to become scientists and engineers—and inspired grownup engineers and scientists to do big things—in recent decades the field has become dominated by escapist fantasies and depressing dystopias. That could be contributing to something that I see as a problem. It seems that too many technically savvy people, engineers in particular, are going to work for Web startups or investment firms. There's nothing wrong with such companies, but we also need engineers to design bold new things for use in the physical world: space colonies instead of social media.

If I'm right, that's bad for all of us. But are we really losing the will to do big things or are the big things just different than they used to be? I asked around and, on this subject, found science-fiction writers to be pessimistic.

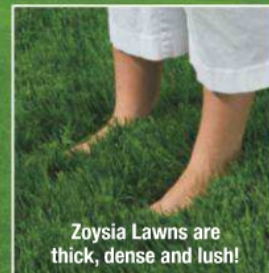
T



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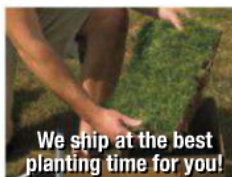
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# THINKING AHEAD/// DREAMING BIG

us, people start to develop skepticism about the scientific method.”

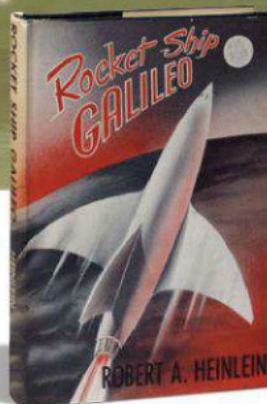
That’s a good point. In the 1950s and 1960s, scientists could cite antibiotics, nuclear energy, and moon flights as evidence that science just plain worked. This gave them credibility on a range of issues.

Facebook doesn’t have the same impact—it’s fun, but even its users don’t see it as an achievement on par with Apollo. Stephenson worries about that: “We’ve had a lost generation of space geeks, who never really got the full brainwash.”

But are things really that bad? I asked another eminent science-fiction author, Vernor Vinge (*A Fire Upon the Deep*, *The Children of the Sky*), to weigh in and, alas, he agreed. Science fiction, Vinge says, has become more escapist but less inspiring. He believes the real problem isn’t to be found in science fiction, but in society. In particular, he argues that we’ve lost “speed of implementation.” We went from experimental jets to the F-104 in a decade, and to outer space in just 10 more years. Nowadays, we’re not so fast, at least with high-visibility projects. (Just look at the bureaucratic inertia around replacing the space shuttle.)

In my day job as a law professor, I tell my administrative law students the same thing. Not far from our campus in Knoxville is Norris Dam. The first dam built by the Tennessee Valley Authority, it was generating electricity three years after the TVA Act passed Congress. If the TVA were created today, three years wouldn’t even be enough time to produce the environmental impact statement. Sure, you can roll out a new social media platform or an iPhone app in a hurry, but do Twitter and Angry Birds improve lives the way rural electrification did?

There is one solution on the horizon. If, as Vinge expects, we reach the Singularity—a moment when artificial



## REYNOLDS'S READS: BOLD, OPTIMISTIC SCIENCE FICTION

**Isaac Asimov, *I, Robot*** Much better than the movie.

**Greg Egan, *Permutation City*** The hardest of hard-science SF, even if it’s about software, mostly.

**Robert A. Heinlein, *Have Space Suit—Will Travel*** The protagonist wins a spacesuit, gets kidnapped by aliens, and saves the world—all with know-how from his high school shop class.

**Robert A. Heinlein, *Rocket Ship Galileo*** The first of Heinlein’s junior-novel series is about a spaceship that looks more like today’s private NewSpace ventures than like anything NASA did.

**Sarah A. Hoyt, *DarkShip Thieves*** Space piracy in the golden age tradition, with an important moral lesson.

**Ric Locke, *Temporary Duty*** Aliens contact Earth, and some Navy enlisted men save the day.

**Lois McMaster Bujold, *The Warrior’s Apprentice*** Birth defects don’t matter when the mind is the real weapon.

**John Scalzi, *Zoe’s Tale*** A plucky heroine deals with aliens in the world Scalzi originated in *Old Man’s War*.

**John Steakley, *Armor*** Key quote: “You are what you do, when it counts.”

**Harry Turtledove, *Curious Notions*** Part of a series of excellent junior novels in the Heinlein tradition.

**John Varley, *Red Thunder*** A modern twist on the build-your-own-spaceship story, and an explicit tribute to *Rocket Ship Galileo*.

**Vernor Vinge, *Rainbows End*** A look at the surprisingly different near-future world of 2025.

intelligences become more powerful than human brains—in a few decades, “we’ll have far more imaginative creatures around,” he says. So long as they’re not Skynet.

For a reality check on the state of innovation, I spoke with inventor Dean Kamen, whose many credits include a portable dialysis machine, a DARPA-funded robotic prosthetic arm, and the Segway—along with the FIRST robotics competitions for middle and high school kids. Kamen was more optimistic than my science-fiction writers. From his perspective, the problem is actually that writers are falling behind. “Science-fiction writers aren’t being imaginative enough to get ahead of the science,” he says. “You walk into a major university medical center and what you find is something way beyond science fiction.”

Kamen agrees that we’re not making enough progress in space, but says, “That’s because of the excitement at home—cloning, curing diseases, extending life.” And yet he agrees with Stephenson’s argument that the Internet, while obviously a valuable tool, can also be an unfortunate distraction: “We’ve given people new ways to communicate but nothing worth saying. I wish people understood the difference between data and information. The fact that it’s easy, fast, and cheap doesn’t mean that it’s valuable.”

At one level, it’s hard to argue that point. Early hominids liked to sit around gossiping. If nowadays we’re picking fleas out of each other’s hair electronically instead of in person, well, that’s sort of an improvement, but it’s not a revolutionary one.

On the other hand, I know a lot of people who have created small but flourishing businesses using the Internet to do things that would have been too difficult in the old days of paper mail and landline phones. In addition, some scientists are using social media



# Do you have constant **RINGING** in your ear?



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*Developed by a rock drummer, it combines select natural homeopathic ingredients for ringing in the ears, which could be welcome relief to thousands.*

Every night for almost 18 years, if I couldn't find a fan, turn on a tv or find loud static from a vacant radio station, then sleeping was impossible. The high-pitched ringing, buzzing and humming kept me up at night. Sluggishness, tiredness and lost energy would be my nemesis the next day. I couldn't sleep. I couldn't concentrate. I couldn't hide from it...It drove me nuts! Headaches, depressive mood swings, testiness, constant state of anxiety. Due to the tenacity of Tinnitus (the ringing in the ears from exposure to loud noises, or in my case, pounding on drums and loud distorted guitar amps behind my head for years), I was determined to find real, pure, silent relief. That's how I discovered Quietus™ ...

### Tinnitus - Who's at RISK?

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- Mining, Drilling & Farming
- Firearms Enthusiasts
- Residential Landscapers
- iPod Users
- Machine Operators
- Night Club Workers
- Musicians

The symptoms of Tinnitus are real. I had what 1 out of 6 Americans get: the symptoms associated with Tinnitus (*ti-nahy-tuh s*) from loud noises that worsen as you age.



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I tried everything from hearing aid sound generators to ginkgo biloba, zinc and magnesium mineral doses to bio feedback. Some of these things helped reduce the ringing, but nothing really worked for me like the active all-natural ingredients of my new homeopathic product Quietus.\*

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Wheels Tires Interior Exterior



to speed progress, long before Vinge's superintelligent AI arrives: Videogamers recently solved a protein-folding problem involving the AIDS virus that had baffled researchers for years. And the crowdsourcing of politics is promoting democracy worldwide. Beyond that, video games have educational potential: My daughter learned a lot about budgeting from *The Sims*.

On balance, though, I have to agree that the kind of progress Neal Stephenson is pushing for is more important. My perspective is informed by something a golden age writer, Robert A. Heinlein, once said: "Earth is too fragile a basket to hold all of our eggs." There are lots of metrics you can use to assess technological progress. But to me, the overarching goal of the next century or so has to be to spread humanity beyond Earth—and, ideally, beyond the solar system.

Between potential natural disasters like asteroid strikes and plagues, and man-made threats like nuclear weapons and biological warfare, the risk that humanity will be destroyed by some catastrophe is unacceptably high. The solution, it seems to me (and to others, like Stephen Hawking), is for civilization to expand so widely that no plausible disaster will wipe us all out.

On this metric, the golden age approach to technology—all those rocket ships and Mars bases—looks better: Facebook *probably* won't save us from economic stagnation; it *certainly* won't save us from an asteroid.

Besides, the golden age approach is just more inspiring. Novels about brooding antiheroes may be good literature, but they likely won't inspire teenagers to study physics or engineering. Golden age science fiction—and in particular, those Heinlein junior novels such as *Have Space Suit—Will Travel* or *Rocket Ship Galileo*—did that.

Neal Stephenson is putting together an anthology of pro-progress science

fiction. And SF writer Sarah A. Hoyt, author of *DarkShip Thieves*, thinks the balance between utopian and dystopian science fiction is already swinging back toward the positive. As evidence, she points to new works such as Ric Locke's *Temporary Duty*, written in the spirit of those old Heinlein novels and

**TO ME, THE OVER-  
ARCHING GOAL OF THE  
NEXT CENTURY HAS TO BE  
TO SPREAD HUMANITY  
BEYOND EARTH—AND,  
IDEALLY, BEYOND THE  
SOLAR SYSTEM.**



trumpeting technical knowledge and self-reliance rather than introspection.

"If the friends I have in science are right, computers are about to explode a bunch of fields," Hoyt says. "I think crowdsourcing research and the faster integration of knowledge, as well as the snowball effect of having reached a certain point in knowledge, are about to unlock all sorts of innovations in computing, biology, pharmaceuticals, genetics, and perhaps things that will get private companies into space."

If all that comes to pass, science fiction could take on the role it had decades ago, dreaming of new horizons while helping people understand and adjust to an evolving reality. "I think my field is on the verge of an explosion of forward-looking and outward-looking works," Hoyt says.

I hope she's right about that too. Science and engineering are about what we can do, but often what we actually wind up doing is driven by the stories we tell. We should make sure they're the right ones.

**PM**





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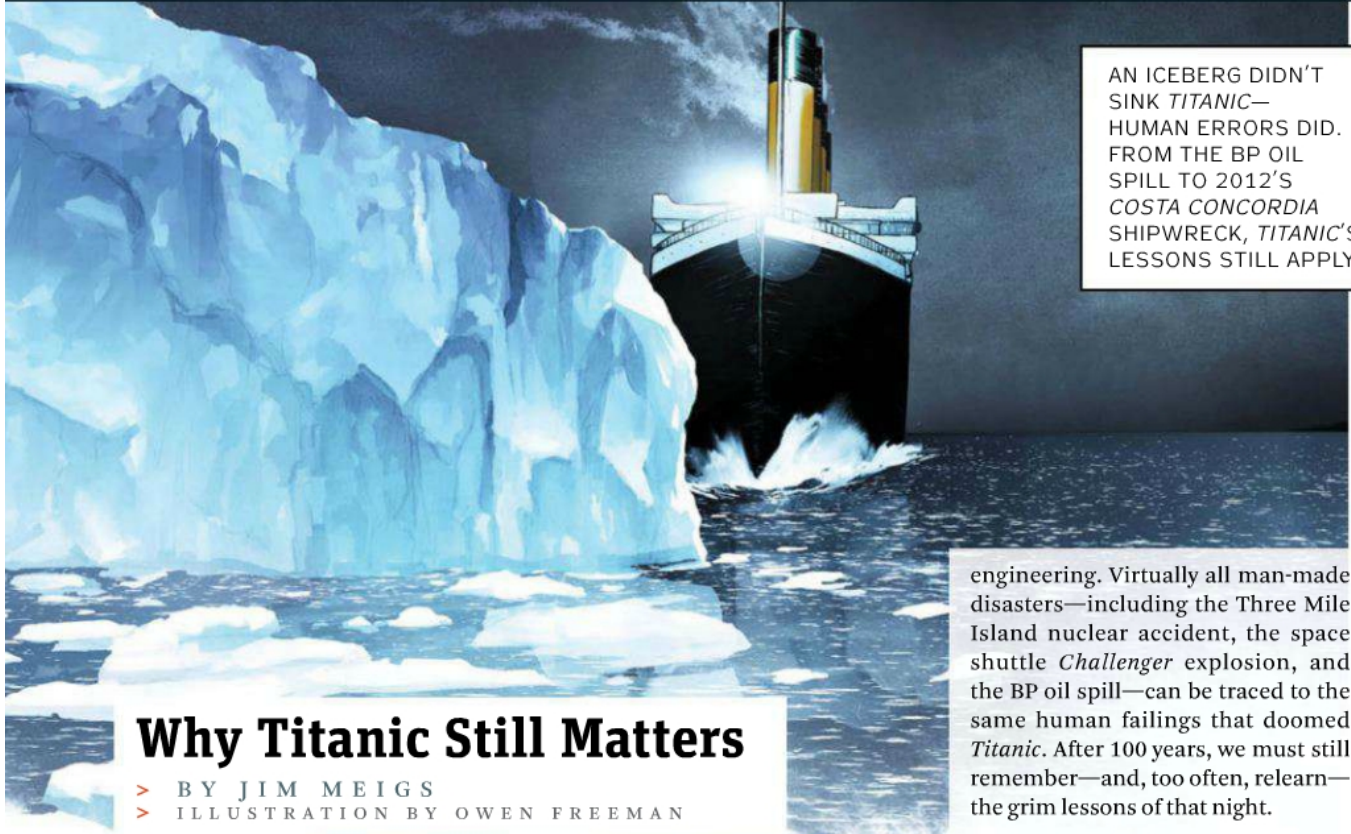
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AN ICEBERG DIDN'T SINK *TITANIC*—HUMAN ERRORS DID. FROM THE BP OIL SPILL TO 2012'S *COSTA CONCORDIA* SHIPWRECK, *TITANIC*'S LESSONS STILL APPLY.

## Why Titanic Still Matters

> BY JIM MEIGS

> ILLUSTRATION BY OWEN FREEMAN

# W

**HEN THE RMS *TITANIC* WENT TO THE BOTTOM** of the Atlantic in the early hours of April 15, 1912, it carried with it the era's uncritical faith in the promise of technology. The ship was the jewel of the industrial age. That such an extravagantly engineered behemoth could fall victim to the everyday risks of sailing the North Atlantic was more than shocking; it set off a period of deep skepticism about the relationship between man and his machines.

A series of inquests and reports laid out the reasons for the catastrophe and led to reforms in marine engineering and maritime law. But one risk factor couldn't be eliminated: human fallibility. In an article published in *POPULAR*

*MECHANICS* soon after the tragic event, we noted that the *Titanic* "simply furnished another example of the well-established principle that if, in the conduct of any enterprise, an error of human judgment or faulty working of the human senses involves disaster, sooner or later the disaster comes."

In one respect, little has changed. As the recent loss of the Italian cruise ship *Costa Concordia* demonstrates, bad decision making can overcome even robust

engineering. Virtually all man-made disasters—including the Three Mile Island nuclear accident, the space shuttle *Challenger* explosion, and the BP oil spill—can be traced to the same human failings that doomed *Titanic*. After 100 years, we must still remember—and, too often, relearn—the grim lessons of that night.

**No disaster is a single event.** Complex systems rarely fail without warning. Instead, accidents are the product of decisions made over hours, days, and sometimes years. Those choices are shaped both by the culture of the organization—whether it's NASA or the White Star Line, which owned *Titanic*—and by outside pressures.

On the morning of Jan. 28, 1986, the launch of the *Challenger* had already been postponed six times. Ever image conscious, NASA brass pushed to launch, despite the objections of engineers who worried that the rubber seals between segments of the vehicle's booster rockets might fail in the unusually cold temperatures. One of those engineers, Allan J. McDonald, recounts in his book *Truth, Lies and O-Rings: Inside the Space Shuttle Challenger Disaster* that



small quantities of combustion gases had leaked through the seals on previous missions. It was a warning sign—but NASA came to accept the leaks as normal. Engineers were forced into the impossible position of trying to convince officials that their worries were valid. “‘Is it safe to fly?’ is the correct question,” McDonald tells *POPULAR MECHANICS*, “not that you have to prove it will fail.”

Like the space shuttle, *Titanic* was the technological pinnacle of its day. But a series of decisions—from carrying too few lifeboats to using a rudder that may have been too small to enable the ship to turn quickly—pared its margin of error. Those risks were compounded by unsafe operation. Accounts differ on whether White Star Line managing director J. Bruce Ismay urged Capt. Edward J. Smith to speed across the Atlantic in the hope of setting a record. But there’s no question that the captain sailed the new and barely tested vessel through a region of known iceberg risk at nearly full speed on a moonless night. (A nearby ship, the *SS Californian*, had stopped for the night.) It was just one more bad decision along the *Titanic*’s doomed path.

**Success can breed complacency.** During a career of more than four decades, the *Titanic*’s Capt. Smith had been involved in only a single accident at sea, one that ended without loss of life. *The New York Times* noted that Smith’s “rise in rank and importance was commensurate with the safe uneventfulness of his command.”

Major disasters often occur after such long, uneventful stretches. Before the partial meltdown of the reactor at Three Mile Island in 1979, no U.S. nuclear plant had experienced a serious accident for 25 years. Similarly, before the blowout of the BP Macondo Prospect well in April 2010,

the Deepwater Horizon rig had gone seven years without a serious mishap while drilling some of the deepest wells on the planet. “When you think you have a robust system, you tend to relax,” Henry Petroski, a professor of civil engineering at Duke University, tells *POPULAR MECHANICS*. Over time BP and its contractors began to cut corners: Alarms that would have warned of a gas leak were silenced, safety checks canceled. The blowout preventer—a last-ditch device intended to shut off a runaway well—was only partly functional. And workers



The *Costa Concordia* foundered off the Italian coast on Jan. 13, 2012. In an echo of the *Titanic* shipwreck, human errors contributed to both the accident and the subsequent loss of at least 17 lives.

were constantly urged to drill faster. That kind of culture invites trouble.

#### **Technology can outpace judgment.**

The construction of *Titanic* came at the apex of a remarkable period of innovation in shipbuilding. Well before the launch of *Titanic*, Capt. Smith expressed supreme confidence in the state of maritime engineering: “I cannot imagine any condition which would cause a ship to founder,” he said in 1907. “Modern shipbuilding has gone beyond that.”

With three powerful engines, *Titanic* could maintain high speeds day or night. But the crew’s ability to spot hazards was little changed from the days of sail. Two men stood in a crow’s-nest scanning the horizon—they didn’t even have binoculars. The ship was equipped with the latest communications innovation, wireless telegraph, and in the hours before the collision the ship received five warnings about icebergs from other vessels. But at the time, the telegraph was seen primarily as a luxury service for passengers, and the crew had no firm protocol for acting on the information. One message was handed to

Ismay, who slipped it into his pocket, apparently unconcerned.

Similarly, at the time of the Gulf of Mexico blowout, BP and its contractors were pushing the art of undersea drilling into ever-deeper waters, using increasingly sophisticated equipment. And yet the procedures to monitor and control these deep wells had not advanced much beyond those used in shallower seas.

#### **Leaders may fail to plan for the worst.**

Just as Deepwater Horizon crews derived a false sense of confidence

from their blowout preventer, the White Star Line put undue faith in the supposedly watertight compartments that composed *Titanic*’s lower decks. The compartments were not sealed at the top; if the ship’s bow dipped low enough, seawater would flow from one compartment to the next like water filling an ice cube tray. The probability of that happening? Low. The consequences when it did? Catastrophic.

And so, the sinking of *Costa Concordia* feels sadly familiar. The ship was studded with technology—what it lacked was good judgment by the people in charge. The captain approached too close to a rocky shore. Then, after the collision with an undersea outcrop, the crew rushed to reassure passengers that everything was fine. Had the crew quickly mustered everyone to the lifeboats instead, there might have been no loss of life. “A tool is only as good as the person that’s using it,” says John Konrad, a U.S. Coast Guard master mariner and author. “All the technology in the world can’t replace a good captain.” That remains as true in 2012 as it was a century ago. **PM**

*Additional reporting by Sarah Fecht*

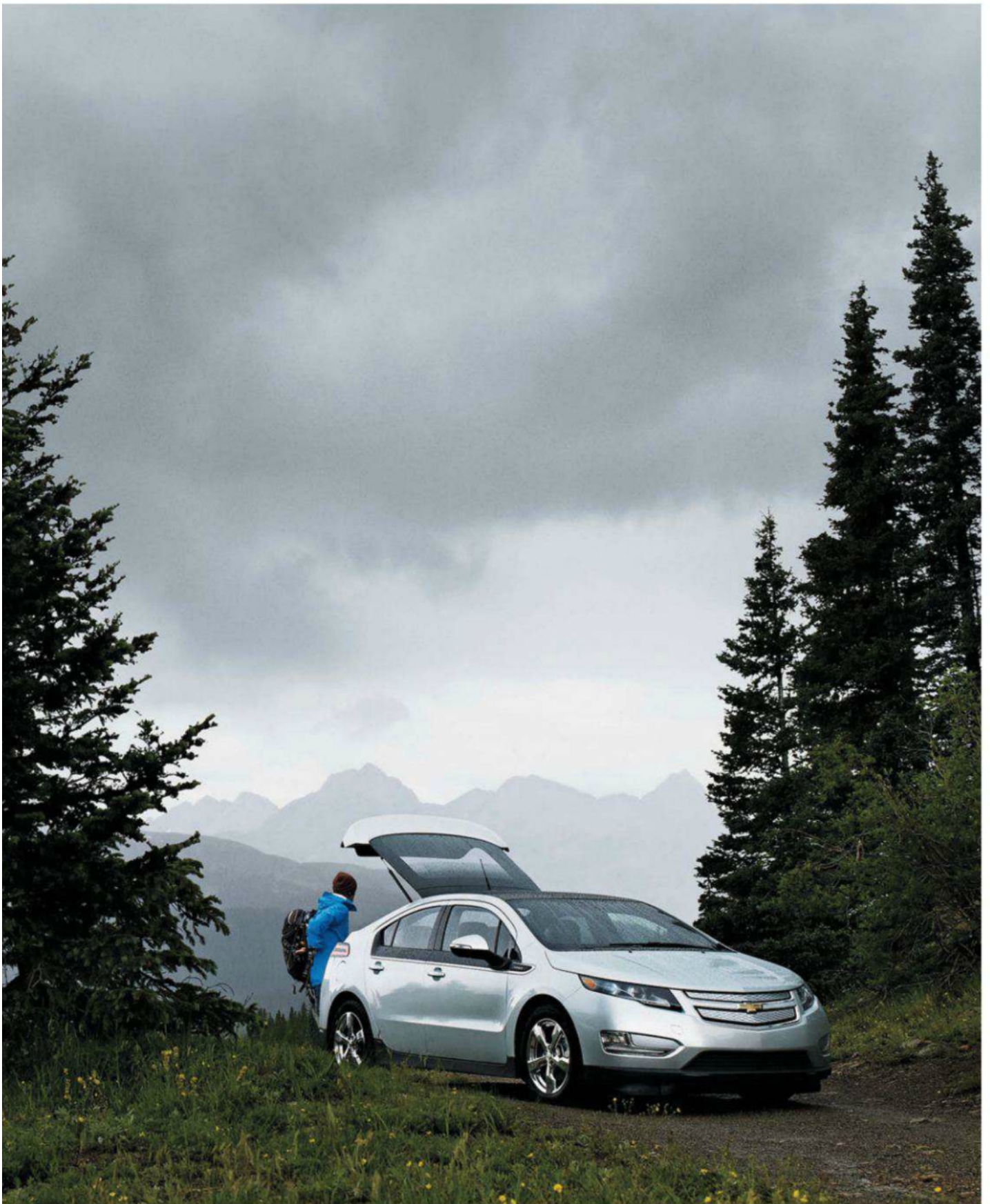


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• WEIGHT: 1.2 MILLION POUNDS • FIRST FLIGHT: 2015 • FIRST PAID FLIGHT: 2020

# STRATOLAUNCH

*THE WORLD'S BIGGEST AIRPLANE WILL HAVE A SIMPLE JOB:  
TAKE A TWO-STAGE ROCKET TO 30,000 FEET, DROP IT,  
AND GET THE HELL OUT OF THE WAY AS IT BLASTS INTO ORBIT.*



STRATOLAUNCH  
WINGSPAN: 385 FEET  
LENGTH: 215 FEET



HUGHES H-4 HERCULES  
("SPRUCE GOOSE")  
WINGSPAN: 320 FEET  
LENGTH: 219 FEET



AIRBUS A380  
WINGSPAN: 261 FEET  
LENGTH: 240 FEET

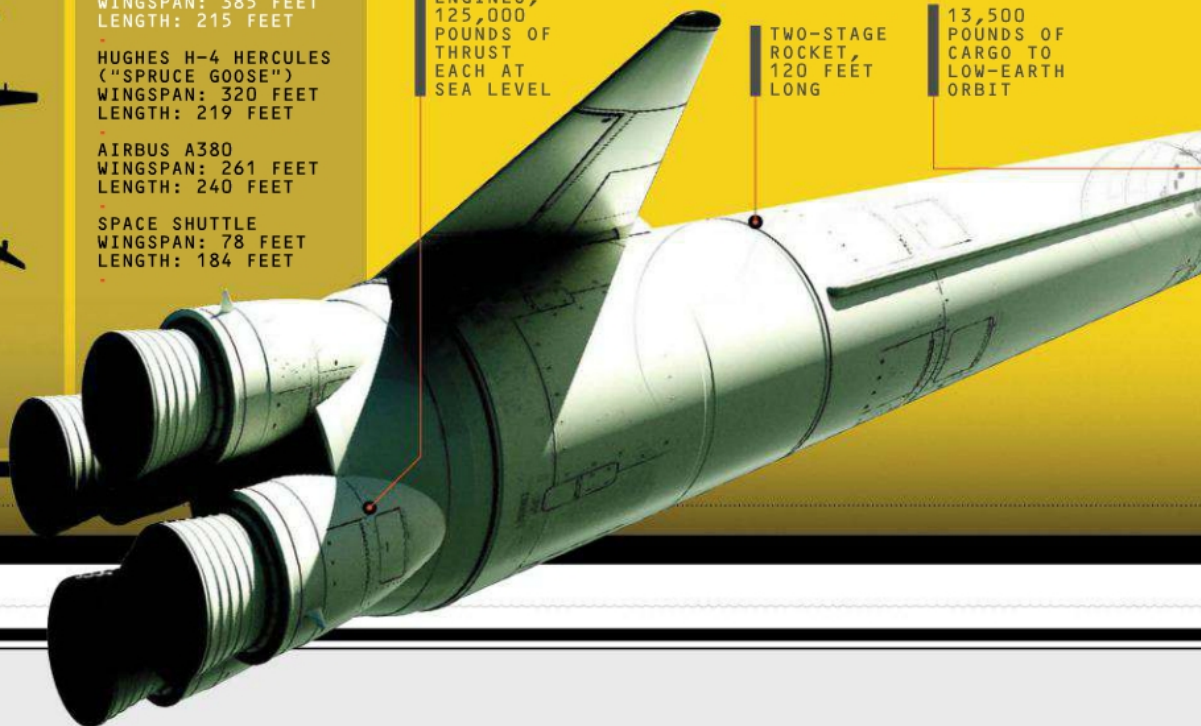


SPACE SHUTTLE  
WINGSPAN: 78 FEET  
LENGTH: 184 FEET


MERLIN  
ENGINES,  
125,000  
POUNDS OF  
THRUST  
EACH AT  
SEA LEVEL

TWO-STAGE  
ROCKET,  
120 FEET  
LONG

13,500  
POUNDS OF  
CARGO TO  
LOW-EARTH  
ORBIT





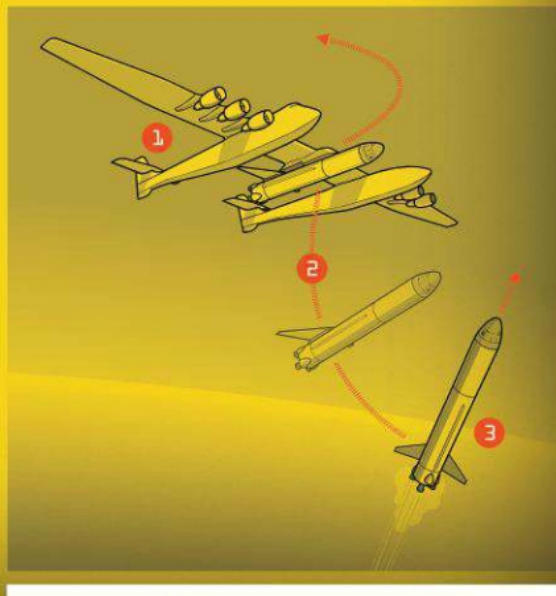


SIX PW4056  
TURBOFAN  
ENGINES  
FROM TWO  
BOEING  
747-400S

1) MOTHER  
SHIP FLIES  
TO LAUNCH  
POINT AT  
30,000 FEET.

2) ROCKET  
BOOSTER'S  
FINS ORIENT  
ROCKET  
VERTICALLY  
AS IT DROPS.

3) ROCKET  
ENGINES  
IGNITE,  
SENDING  
PAYLOAD  
TO ORBIT.



BY MICHAEL BELFIORE

Stuart Witt guns the motor of the white SUV known as Mojave One and drives it up a dun-colored mound of earth. From atop his wind-swept perch, the CEO of the Mojave Air and Space Port surveys a fleet of graders and other heavy equipment churning up 19 acres of dirt beneath a blue desert sky.

At the moment, it's just a sprawling construction site, but within two years, work will be completed on a pair of hulking buildings. One will be a fabrication facility for the world's biggest airplane. The other will be the hangar that houses it. "You're looking at something that's going to be fundamen-



## Air-to-Space Dream Team

There are plenty of ambitious private space companies, but the reputations of the three partners behind Stratolaunch Systems raise expectations sky-high. Each has made a career by defying the status quo.

tally breathtaking," Witt says.

The official name of the mammoth aircraft is Model 351, but it already has a nickname: the Roc, after the mythological bird big enough to carry away elephants for dinner.

The record-breaking plane, which will have six engines and twin fuselages, is being built to carry a rocket to 30,000 feet. From there, the rocket will drop from the plane and blast into space. The first payloads will consist of satellites and other cargo, but the program's backers say the rocket will eventually carry passengers. The Roc will be a flying launchpad—government and private-sector customers welcome.

Incredibly, the project has been in development for more than eight years under total secrecy. Then, this past December, billionaire Paul Allen announced his Stratolaunch project to the world at a press conference in Seattle. When the space shuttle fleet was retired in 2011, the United States lost its only way to get astronauts off the planet. Stratolaunch is the latest private-sector initiative to try to fill that void. "For the first time since John Glenn, America cannot fly its own astronauts into space," Allen said in Seattle. "Stratolaunch will build an air-launch system to give us orbital access to space with greater safety, flexibility, and cost effectiveness, both for cargo and manned missions."

In the process, the Stratolaunch team hopes to build a new American spaceflight industry. But there are more than government contracts at stake: When the cost of launches decreases, more industry satellites, tourists, and science projects will reach orbit. Space will truly be open to the public.

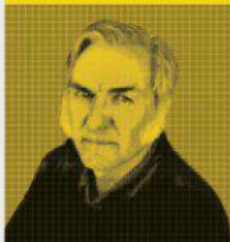
To reach that lofty goal, Allen has assembled a team of mavericks from the private space industry to make Model 351 into flight-ready hardware. Scaled Composites, a



### THE AIRPLANE:

**Burt Rutan** Founder, Scaled Composites

This forceful, iconoclastic, and brilliant engineer is best known for designing SpaceShipOne, the first privately built craft to carry people into space. Rutan, now retired, sits on Stratolaunch's board of directors; Scaled is building the airplane.



### THE ROCKET:

**Elon Musk** Co-founder of PayPal, Tesla Motors, and Space Exploration Technologies (SpaceX)

Musk's rocketeers are trying to make SpaceX the first private company to resupply the International Space Station—and create a launcher that costs one-quarter the price of comparable rockets.



### WHY BUILD A NEW AIRPLANE TO FERRY ROCKETS?

"SPECIALIZED AIRCRAFT FOR SPACE LAUNCH ARE OPTIMIZED FOR THEIR PAYLOADS," BURT RUTAN SAYS. "JOINING TWO 747S WOULD NOT GET YOU AN AIRPLANE CAPABLE OF LAUNCHING THE STRATOLAUNCH BOOSTER."

Mojave-based firm founded by designer (and POPULAR MECHANICS Breakthrough Award winner) Burt Rutan, will make the airplane. "To allow public access to orbit, we need to increase safety by a factor of 100," Rutan, who sits on the Stratolaunch board of directors, says. "I think airborne launch will be a significant part of the safety solution."

The rocket will also be made to order. For that, Allen approached PayPal co-creator Elon Musk, who founded Space Exploration Technologies (SpaceX). Building a two-stage rocket that will be dropped from an airplane is the kind of bold challenge that SpaceX was created to tackle, but hitting the specifications for mass, center of gravity, and other technical details will be tricky. "We're in what I call the rocket-design box," Gwynne Shotwell, SpaceX's president, says, "where we can be only so long and weigh only so much but still need to get a specific amount of payload to orbit. Piece of cake."

### FLIGHT OF THE ROC

In 2015, hangar doors wider than the length of a football field will slide open. The 600-ton Stratolaunch mother





#### THE MONEY:

**Paul Allen** Co-founder, Microsoft

This billionaire was the sole funder of Rutan's SpaceShipOne project. Stratolaunch, which will be the first wholly privately funded space transport system, is his second space venture. "It will keep America at the forefront of space exploration," he says.



#### THE AIRFIELD:

**Stuart Witt**  
CEO, Mojave Air  
and Space Port

Witt has been privy to the Stratolaunch plan for years and prepared his facility for its commencement. He extended runways and oriented the Stratolaunch's hangar doors so they will open directly onto a runway he extended in 2007.

ship will lumber directly onto Mojave's Runway 30, which extends 12,500 feet through the desert scrub toward the windmills churning the air in the foothills of the Tehachapi Mountains. The Roc's gleaming white, 385-foot wings will cast long, slender shadows as the plane moves into the bright California sun.

When air traffic controllers clear the Roc for takeoff, its crew will throttle up six Pratt & Whitney 4056 turbo-fan jet engines, each of which generates about 60,000 pounds of thrust. The high-pitched turbine whine of a four-engine 747 reaches 140 decibels during takeoff. That's 20 decibels above the pain threshold—and the Stratolaunch vehicle will have two additional engines. The shriek of the

Roc on takeoff will echo for miles—one good reason to base its development in the empty desert at Mojave. Accelerating down the runway will put some flexion into the wings, likely giving them a bit of a flapping quality as the plane takes off.

Mojave will host test flights. Paid space launches, scheduled to begin in 2020, will depart from Cape Canaveral, Fla. There the aircraft will carry a 120-foot rocket mounted to the bottom of the spar connecting the fuselages. The sight will be dramatic—an airplane with a wingspan greater than the

## Why Air Launch?

Launching spacecraft from airplanes is not a new concept—and it has advantages over a ground launch. An air-launched rocket is lighter because it needs less fuel to reach orbit and doesn't require shielding to protect it from the engines' acoustic energy, which reflects off the ground.

PHOTOGRAPH BY DAN CHAVKIN



length of a football field, carrying a rocket with wisps of vapor escaping from its cryogenic liquid oxygen tanks.

Allen envisions the system one day delivering as many as six people per flight into space. The passengers will buckle into seats inside a capsule at the rocket's tip. Assuming the capsule has windows, these paying customers will be treated to views of the receding Florida coastline and, after a steady climb, the curvature of Earth.

And then it gets exciting. Once at 30,000 feet, the Roc's crew will start a brief count-down and flip the sequence of switches that releases the rocket. The Roc's pilots will then veer away sharply to stay clear of the rocket's flight path.

During the drop, the rocket's fins will pitch the rocket at a steep angle for its impending climb to space. The capsule passengers' orientation will shift: Imagine tipping over your chair, and that brief but gut-wrenching free-fall. And then imagine being slammed back into your seat by g-forces as the rocket's engines ignite, expelling a half-million pounds of thrust.

Once in space, 298,000 feet above the release point, the rocket will drop the first stage, and the second will fire, flinging the capsule (or 13,500 pounds of payload) the rest of the way into orbit. By then, the passengers will be floating in their harnesses.

## ■ BLASTOFFS FROM ALTITUDE

Launching spacecraft from airplanes is an idea that is as old as spaceflight. In the early 1960s, pilots—including future Apollo 11 astronaut Neil Armstrong—began shooting for the edge of space in X-15 rocket planes dropped from B-52 bombers. In the late 1990s, the Pentagon began investing in air-launch ventures to develop the capability of deploying a spy satellite over an unexpected hotspot or replacing a disabled sat. Private space companies have launched small rockets from converted civilian airliners and the cargo bays of military transport aircraft (see “Why Air Launch?” page 65). But the concept has never before been tried on the scale of the Roc.

Rutan and Allen's earlier space collaboration now seems like a test run for Stratolaunch, both in terms of strategy and design. In 2004, a mother ship called the WhiteKnight carried a manned spacecraft, SpaceShipOne, to launch altitude. From there SpaceShipOne reached 328,000 feet and then landed under its own power. When Scaled was able to repeat the feat within 14 days, the company won the \$10 million Ansari X Prize. Like the Roc, the WhiteKnight carried its payload between twin spars, but the Stratolaunch aircraft's cockpit is nested at the tip of one spar.

Allen won't confirm Stratolaunch's price tag, but he says it “is going to end up costing at least an order of magnitude more than what I put into SpaceShipOne [\$28 million].” Allen and company believe that the hundreds of millions of dollars and the design challenges of the project will be offset by an “any orbit, any time” capability.

When launching a spacecraft to a target in orbit—say, a space hotel—a launch provider can either wait until the facility is overhead or launch, enter orbit, and spend days chasing the destination. But the Roc will be able to take off from any runway long enough to accommodate it, fly 1500 miles, and launch a rocket when the orbital facility is overhead.

The Stratolaunch team isn't speculating as to

This Pratt & Whitney 4056 engine, shown here on a former United Airlines 747-400 that landed at Mojave Air and Space Port in early February, is one of six to be used on the Stratolaunch mother ship. Engineers will cannibalize the jet's landing gear too.



↑ **1963: NASA pilot** Joseph Walker reaches space three times in an X-15 rocket plane dropped from a B-52. He is the first person to get to space more than once.

**1990: Orbital Sciences** becomes the first private space launch company when it drops a Pegasus rocket from a B-52. The system, using a Lockheed L-1011, is still in operation.

**2004: Scaled Composites' WhiteKnight** takes off from California's Mojave Air and Space Port and launches SpaceShipOne from its position beneath the plane's central fuselage. A larger version, WhiteKnightTwo, is undergoing flight tests.



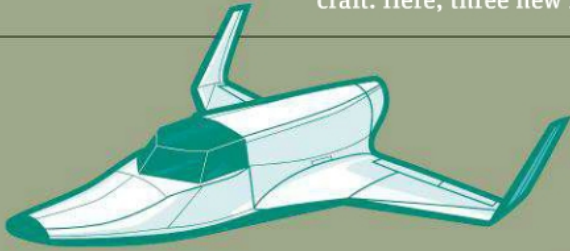


PHOTOGRAPH BY **DAN CHAVKIN**



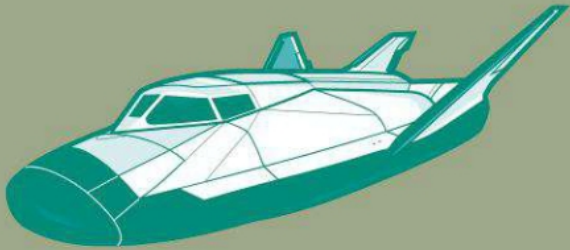
## Private Space Planes

The huge plane in the Stratolaunch system is used to hoist a rocket to high altitude, release it, and then veer away as the rocket launches into space. But the mother ship itself is not a space plane. That designation is reserved for aircraft that can reach space under their own power, maneuver there, return to Earth, and land. Private space companies are busy designing these reusable craft. Here, three new models.



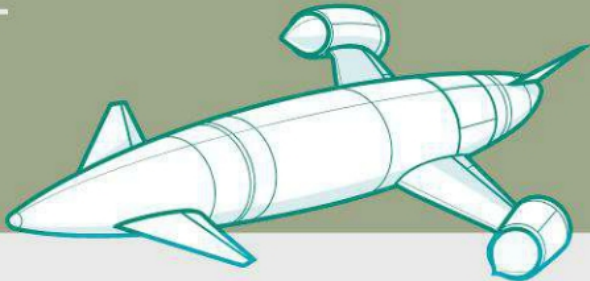
### LYNX / 30 feet long

This suborbital-only space plane from XCOR, based at California's Mojave Air and Space Port, is designed to fly microgravity research payloads, as well as tourists, just past the edge of space. Taxi tests are scheduled for late 2012; a short first flight could come by year's end.



### DREAM CHASER / 30 feet long

This seven-passenger space plane, developed by Sierra Nevada Corp., will launch from Cape Canaveral atop an Atlas V rocket, enter orbit, return to the atmosphere, and land on a conventional runway. NASA-funded testing means first flights as early as this summer. Sierra Nevada says regular flights will start in 2016.



### SKYLON / 269 feet long

This single-stage unpiloted craft, made by England's Reaction Engines, will blast directly into space from a runway without a boost from an airplane or rocket, carrying cargo or a passenger compartment. Engine tests began last year; company engineers expect flights within a decade.

who or what will eventually hire the system to fly to space. "Paul has tasked us with getting the design moving forward," Stratolaunch president and former NASA chief engineer Gary Wentz says. "Right now we're not pursuing customers."

## SCAVENGED HISTORY

In early February a pair of United Airlines 747s from Victorville, Calif., landed at Mojave. They

won't leave intact. The two aircraft will be cut to pieces and their parts repurposed for the Stratolaunch prototype, including the six engines that will be mounted on the Roc's wings. Engineers will also cannibalize the airliners' landing gear.

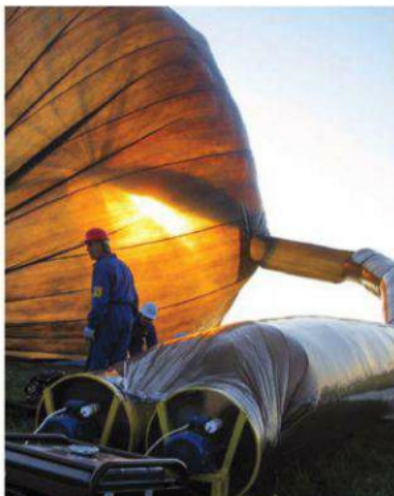
The Roc's airframe will be new, built of carbon fiber. Aerospace engineers are finalizing that design in Scaled's engineering offices in Hangar 78 at Mojave. "We've grown up with airplanes that are of a scale where you call 10 of your buddies over and say, 'I'm going to put this wing on today,'" Kevin Mickey, Scaled's executive VP, says. "Building an

airplane of this size is more of a shipyard-type logistic challenge." So cranes and big jigs will be the order of the day.

The Roc is not regarded as pretty, even by its creators. "We're all air-

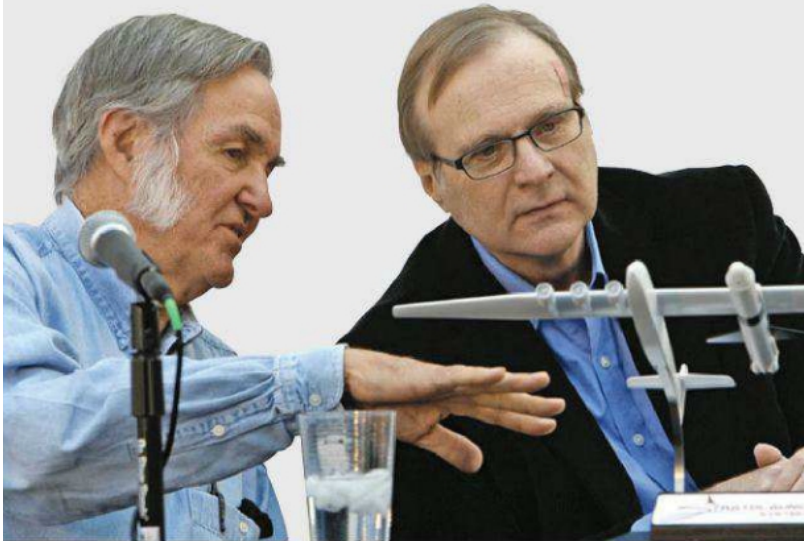


**2006: AirLaunch**, a Seattle-area company working under a Pentagon contract, drops a space rocket from the backdoor of a C-17, setting a record for the heaviest single object dropped from the military cargo plane—65,000 pounds. In 2008, when the contract ends, the company folds.



**2010: Google Lunar X Prize** competitor ARCA, based in Romania, announces plans to launch a three-stage space rocket from a balloon. In October 2010, ARCA fires a prototype rocket from a balloon at 45,000 feet.





Rutan (left) and Allen—  
with a model of what  
will be the world's  
biggest airplane—  
announce the Strato-  
launch project at a press  
conference in Seattle in  
December 2011.

craft guys; we love swoopy shapes,” Scaled program manager Joseph Ruddy says. “But that’s not this thing’s job. This thing’s job is to carry this rocket and drop it.”

Engineer and test pilot Doug Shane, Rutan’s successor as head of Scaled, says the team will fabricate as many identical carbon-fiber-skin sections as possible. “If you look at our products, it’s very unusual to have any common geometry to any adjacent part of the vehicle,” Shane says. With flat sides on the fuselage, Scaled can make panels and clone the part for use almost anywhere on the airplane.

Given Rutan’s penchant for aviation firsts—aircraft based on his designs have set multiple round-the-world records—one might suspect he joined the Stratolaunch project partly because it gives him a shot at one last career-capping superlative. But Rutan strongly disagrees with that view. “It would be nice to *not* have to build the world’s largest airplane to do the Stratolaunch mission.”

## ■ FOR-HIRE ROCKETEERS

No one at Mojave is currently building rockets at the Stratolaunch scale, so Allen turned to Elon Musk. His SpaceX skunkworks is brazenly rewriting the rules of spaceflight by creating and launching rockets quickly and cheaply.

The company has already flown the Falcon 9 rocket, named for its nine main engines, and the Dragon space capsule into orbit. The company is now preparing for cargo flights to the International Space Station. Musk says manned flights could commence as early as 2014.

The Stratolaunch rocket will have the same diameter as the Falcon 9 (12 feet), but engineers will trim its length by about 60 feet. “We call it the Falcon 9 Shorty,” SpaceX president Shotwell says. Engineers will stunt the rocket by taking out some of the barrel sections that they weld together to make up a typical Falcon 9.

Many elements of the design are not yet finalized. Even the number of rocket engines has not been settled: Shotwell wants to stick with nine engines; Wentz wants fewer. “Nine engines are not required for the performance or control of this rocket,” he says. “Including them would add cost and mass.”

They have to come to an agreement quickly, as the project is on a tight schedule. Wentz’s timetable calls for Roc flight tests to start in 2015; flights with an actual rocket won’t begin until 2020 in Florida.

Scaled must lure engineering and design talent to Mojave to staff up Stratolaunch. “The biggest challenge is finding the people who have the right mindset to do this kind of work, who want to take responsibility for the parts they do [create],” Ruddy says. “We have to adjust them to our culture. A lot of aerospace is geared to production-type mentality. The prototype world is a little different.”

Stratolaunch suits Witt’s vision of Mojave as the center of this prototype world, where cutting-edge aerospace companies have the room to innovate. “What brought the Wright brothers to Kitty Hawk was freedom from encroachment of the press, freedom from industrial espionage, and a steady breeze,” Witt says. “The fact that we were able to keep this under wraps for nearly nine years says that we still enjoy the elements that took Orville and Wilbur to Kitty Hawk.”

No one will easily mistake the 1.2-million-pound Roc for the 605-pound 1903 Wright Flyer. But if this astounding piece of engineering takes to the sky, engines screaming and rocket blazing, the aerospace pantheon will welcome a new aircraft—a very big one.

**PM**



# CLIMBING *the* IRON WAY

Fixed rungs, cables, bridges? Sounds like sacrilege to climbing purists.  
To the rest of us, a via ferrata (Italian for “iron road”) means a way to reach new heights.

BY JIM GORMAN | PHOTOGRAPHS BY JASON GOULD







Don't look down!  
The author finds  
sheer adventure  
on the cliffs of  
Nelson Rocks,  
W.Va., thanks to  
a network of steel  
hardware.



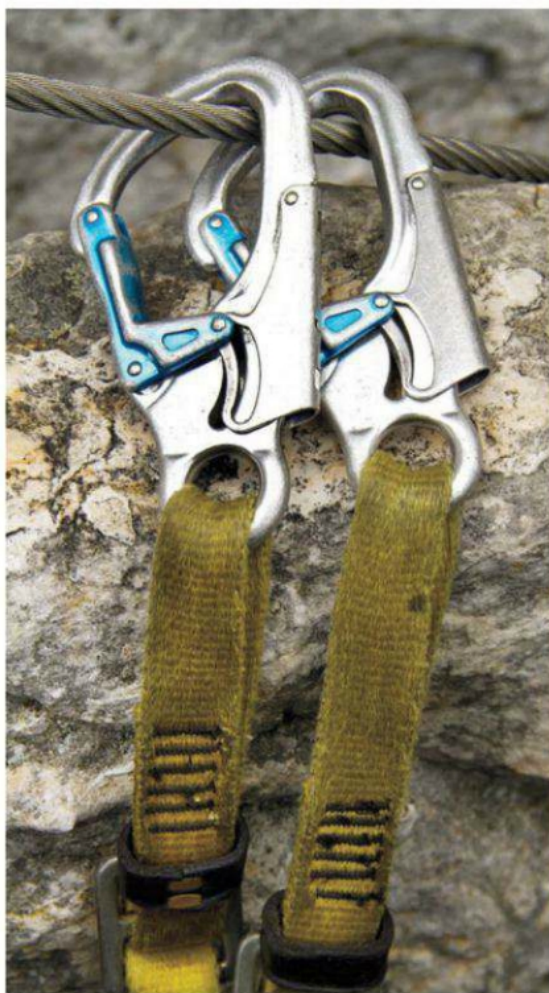
*CLICK, CLACK. CLICK, CLACK.* THE clatter of aluminum carabiners clipping and unclipping fills the air on this late summer afternoon. Pendulous clouds drape the upper slopes of Spruce Knob, the highest peak in West Virginia, and threaten rain. At the moment, though, only a fine mist penetrates a canopy of oak and locust at the base of Nelson Rocks, where guide Josh Armstrong and I watch nine climbers, led by guide Jason Cain, scale a 100-foot-high quartzite cliff on ladder-like rungs anchored in the rock. Each climber wears a harness with a pair of carabiners on lanyards clipped to a steel safety cable that runs alongside the rungs. At 6-foot intervals, when a climber reaches one of the eyebolts that anchor the cable to the cliff, he or she detaches one carabiner from the cable, clips it back on the cable above the bolt, and then does likewise with the trailing carabiner. *Click. Clack.*

"You're up," Armstrong says. He isn't a rock-climbing guide in the traditional sense. No rope runs reassuringly through his expert hands to my climbing harness. He can't catch me if I fall—and falls are heavily discouraged. Slipping off the metal rungs might cause more injury than a fall while roped and on belay in conventional rock climbing. "We don't have a dynamic rope to catch us, or someone on the ground to absorb the shock of our fall," Cain said before the climb. "We are falling on stainless-steel cable. Doesn't stretch much. These lanyards? Not going to stretch much. We can generate a lot of force with a fall. It's going to hurt. So no falls."

No falls. Okay. A familiar nervous anticipation overtakes me. I have a fair amount of experience on rock, though it's been a while since I've ascended anything higher than a



The team of climbers that built the Nelson Rocks via ferrata used Epcon A7 (left), an anchoring adhesive, to secure the 18-inch eyebolts (right, center) that hold up the route's 220-foot-long suspension bridge. Drilling the hole for each eyebolt destroyed three carbide-tipped masonry bits.



Every 6 feet, climbers must unclip their carabiners (left) to move past the bolts securing the safety cable to the rock. Repositioning the 'biners one at a time ensures a constant connection to the cable. Via ferrata builder Doug Downs (above) holds an extra-wide rung. All rungs have a welded rivulet on the top side for added grip.



30-foot climbing wall. But with all this metal support, I'm confident enough to clip both carabiners to the steel safety cable, grab a rung, and start to climb. I won't unclip for 5 hours.


one of the most unusual geologic formations in the East to exploration. Parallel fins of exposed Tuscarora quartzite rise high above the North Fork Valley like the bony plates on the back of a stegosaurus. Just 220 feet separate those fins, and in an inspired feat of amateur engineering, the via ferrata's builders link them with the route's most spectacular feature—a suspension bridge spanning the distance.

**A** FIXED ANCHORING SYSTEM like the one at Nelson Rocks is known as a via ferrata—Italian for “iron road.” It stays put while the climbers move on: no ropes to lug, no specialized gear to buy, no esoteric techniques to learn. These networks of ladders, cables, and bridges were developed in the Dolomites during World War I, when they were used to move supplies and infantry through otherwise impassable terrain. After the war, mountaineers took over the routes, and today, hundreds of via ferratas enable even raw beginners to access dramatic ridges and peaks in the Alps and Pyrenees.

On this side of the Atlantic, however, via ferratas are practically unknown. The route at Nelson Rocks is one of only a handful in the U.S. and Canada, although Whistler Blackcomb in British Columbia and other ski areas have discovered that the iron roads can complement summertime ziplines and waterfall canyoneering (see “More Via Ferratas,” page 74).

At the Nelson Rocks Outdoor Center, the 1750 feet of  $\frac{3}{4}$ -inch aircraft-grade stainless-steel cable (tensile strength: 11,800 pounds), the 115 stainless-steel rungs, and the 145 iron bolt hangers that went into building the via ferrata open

**T**HE ROUTE BEGINS NEAR THE southern end of the west fin. Soon trees that towered above me at the base appear below as nubs in a green shag carpet. Near the top of the fin, which has narrowed to less than 6 feet, I enter a cleft in the rock, take a few steps, and emerge in a portal with a spectacular view on the other side of the cliff—the east fin,



Doubling up on protection, Nancy Tilton (left) has clipped one carabiner above an eyebolt. She reaches to unclip a second carabiner and move it past the obstruction to continue her ascent.



rearing up out of the hardwood forest, and below, the spindly suspension bridge that spans the gap.

The bridge is composed of wire handrails, an overhead safety cable, and 2 x 4s spaced 16 inches apart. From the portal I step off a rung, scramble along a ledge, and then climb onto the bridge. It's like walking on a ladder laid flat—if that ladder were swaying in the wind 150 feet above the ground, bucking with each step.

Not everyone who attempts the via ferrata has the nerve to walk these planks, so an escape route just before the bridge leads to a hiking trail back to the base. Although the bridge is scary fun, the truth is that in building it, as with every aspect of the route, overkill ruled.

Stu Hammett, a lanky 53-year-old who speaks in a clipped Tidewater cadence typical of southern Maryland, bought Nelson Rocks in 1997, just three years after a 40-foot climbing fall left him partially paralyzed. But he was determined to climb

again and to own land in the North Fork Valley, which he had come to love on climbing trips. With the help of special braces, he got back into the sport. A story in the local paper alerted him to the sale of the Nelson Rocks property, making the other dream possible.

An initial stab at opening the crag to climbers on a fee basis failed to cover costs. Then in 2001, Hammett read an article about a via ferrata that had just opened at Torrent Falls in Kentucky. "I knew right away that's what I'd build," Hammett says. "I got a quote from a French via ferrata builder and I said, 'There's no way I'm paying that price.' This is West Virginia, where we know how to do things ourselves."

Hammett hired seven self-

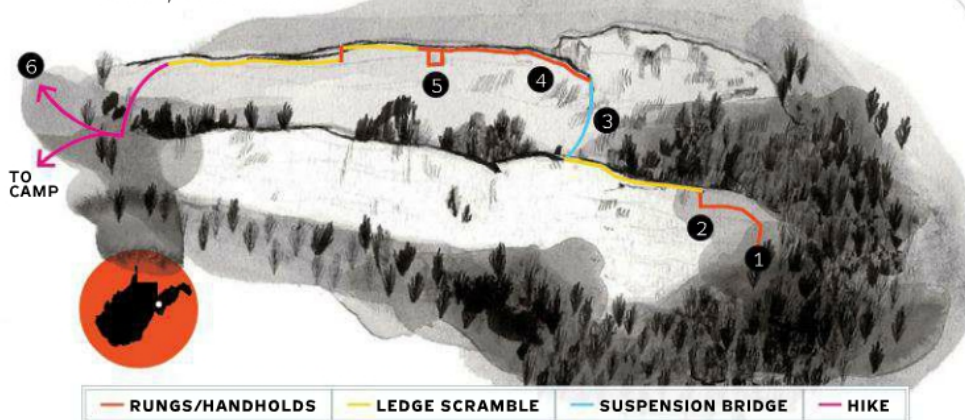
described "dirtbag" climbers from up the road at Seneca Rocks to do the build, which began in February 2002. "I wanted something that would still be there when the rock wore away to dust, but it was all built by seat-of-the-pants engineering," Hammett says. They planned the via ferrata around established climbing routes and to take advantage of the formation's features. Working from the ground up, the builders drilled and glued in 115 rungs that can each support an estimated 9000 pounds.

To build the bridge, a team on top of the west fin dropped a static line and a 6-mm cord, which a second team hauled across the gap and to the top of the east fin. Once the static line was taut, the east fin crew pulled the cord across as the west fin crew attached carabiners to link the line and the cord at 15-foot intervals, creating a trolley system. When the carabiners were attached, the west fin crew hauled the trolley back and clipped in a ¾-inch galvanized steel cable, which the crew on the east fin pulled across the gap. "The cables were so heavy, they would've sagged," says Doug Downs, who helped build the route. "We didn't have the tools or the manpower to pull a big sag out of the cable." Once that cable was secure, the process was repeated until all the cables were in place. The carabiners were unclipped, and the crew rode across on pulleys to complete the bridge.

The bridge load is carried by eyebolts anchored with acrylic adhesive in holes 18 inches deep. It took two climbers on rappel to bore the holes—one to wield a hammer drill and the other to press against the driller's back, gaining leverage by stuffing climbing cams into cracks and pulling hard on the attached ropes. There are 10 anchor holes; each required 90 minutes to drill. "It was a three-dimensional puzzle to put the anchors in the right place so that when the cables were tensioned, they were in the proper relationship," Hammett says. "We'd be up late drinking beer and trying to solve the next day's problems. There were arguments, some sore feelings, but it was one of the most exciting times of my life."

## VERTICAL CHALLENGE

THE FIXED ROUTE AT WEST VIRGINIA'S NELSON ROCKS GAINS 1000 FEET IN HALF A MILE. THANKS TO METAL RUNGS AND STEEL CABLE, EVEN BEGINNERS CAN TACKLE THIS CLIMB.



**1 //** After clipping on to safety cables, climbers ascend 250 feet up the west fin. The start of the route incorporates both metal rungs and scrambles up ledges.

**2 //** When climbers step through a cleft in the rock known as the Scheisse Notch, they confront a steep drop-off that descends

300 feet to a creek.

**3 //** Climbers scramble along a ledge, gaining 80 feet in elevation, then cross the 150-foot-high suspension bridge.

**4 //** Now on the east fin, climbers ascend 80 feet to a formation that looks like a *T. rex* head with its mouth agape.

**5 //** Optional headwall: 60 feet high and topped with a 6-foot-wide ledge.

**6 //** After completing the via ferrata, climbers hike to the 3120-foot summit of Nelson Rocks for 360-degree views that include Spruce Knob, at 4863 feet the highest point in West Virginia.



The wooden slats of the 220-foot-long suspension bridge that links the east and the west fins of Nelson Rocks are widely spaced to allow wind to blow through, which keeps the structure from swaying excessively.



# m

MAINSTREAM CLIMBERS AND managers of public land agencies are uneasy about marring rock with anything man-made. When sport climbing, which uses permanent anchor bolts, came to the U.S. from Europe in the late 1980s, it sparked controversy among traditional climbers. The conflict eventually faded. Still, says Brady Robinson of the climber advocacy group Access Fund, gluing rungs and bolting cable into rock with the intent of making money is “shocking to plenty of climbers. But via ferratas are not inherently bad. You just don’t want one in pristine wilderness or untracked forest.”

By locating the outdoor center on private land, Hammett escaped opposition. But the via ferrata still raises questions, even with Downs. “I’ve always battled with whether the via fit in my ethical boundary,” he says. “Are we allowing people who shouldn’t be up there to be up there, or are we furthering conservation by bringing people somewhere they wouldn’t be able to

go, so they can see it and support its protection?”

Whether I could have scaled the crest of the east fin without the metal rungs is questionable. The headwall guarding it is intimidating: 60 feet high and overhanging. Climbers are forced to lean back slightly, which tires the arms. As I climb, I pause to watch as the cloud deck that shadowed us all day breaks apart, and sunlight turns dull-colored rock to gold.

I had intended to stand, arms outstretched, when I reached the apex. But the perspective here is dizzying. The block appears to be suspended in midair, and though I’m still safely clipped to the via ferrata, I have an overpowering sensation of being airborne—and a case of vertigo. The best I can manage is a surfer’s crouch. So I move my carabiners past the bolts one at a time and head for solid ground. *Click, clack. Click, clack.* **PM**



A professional motorcycle rider, Aaron Colton, is captured in the middle of a 270 stoppie on a street. The rider is wearing a white racing suit, blue jeans, and a Red Bull helmet. The motorcycle is orange and white, with various sponsor logos including Red Bull, EBC, and others. The bike is balanced on its front wheel, which is on the ground, while the rear wheel is in the air. The rider is leaning forward, maintaining balance. The background shows a city street with trees, a tall building, and a clear blue sky with some clouds. A red circular graphic with the text "RIDING THE EDGE" is overlaid on the image, with a line pointing to the front wheel.

RIDING  
THE  
EDGE

+ During a practice run before the XDL Championship Series in Indianapolis, pro rider Aaron Colton pulls a 270 stoppie, which involves spinning the bike 180 degrees on the front tire and then completing the last 90 degrees in the air.



BY CHRISTOPHER MAAG  
PHOTOGRAPHS BY JAKE STANGEL



THOSE OUTLAWS WHO USED TO POP WHEELIES ON THE HIGHWAY? THEY DITCHED THEIR DAREDEVIL PAST AND MADE STUNT BIKE RIDING A LEGITIMATE SPORT. ALONG THE WAY, THEY ALSO MADE AN AMAZING DISCOVERY: **MOTORCYCLES CAN FLY.**

WHILE RIDING A WHEELIE AT 30 MPH, Aaron Colton guns the gas. His motorcycle leaps off its back tire and into the air, a 400-pound blur of black metal and orange plastic. Both tires slam to the ground, and with the bike still moving forward, Colton taps the front brake, snapping the bike's rear tire in the air while he keeps the bike balanced and rolling fast on the front tire—too fast. He's almost out of pavement. Colton quickly drops the back end and clamps down hard on both brakes. The bike shimmies sideways, sliding to a stop right before crashing into a barrier.

And that, my friends, is a wheelie-bunny-hop-into-stoppie, one of the most dangerous trick combinations in sportbike stunt riding. Only a handful of riders in the world can land it. "I ran a little too fast and hard," Colton says afterward, sweat streaming down his cheeks. "Even to me, what we're doing out here is pretty mind-blowing."

Colton is competing in the XDL Championship Series, a two-day event on a closed-off street in downtown Indianapolis. Indy is the last of five XDL competitions held





**+** *XDL veteran Chris "Teach" McNeil, a Latin teacher at a middle school in Maine, practices a stoppie (foreground) while fellow stunter Aaron Colton sits on his gas tank and does a Special K wheelie. The stoppie, itself a dangerous stunt, is the launching point for a host of new aerial tricks. Coasting on their front wheel, riders squeeze the front brake, which compresses the fork, effectively turning it into a loaded spring. With enough speed and force, bikes can leap up to 2 feet in the air.*

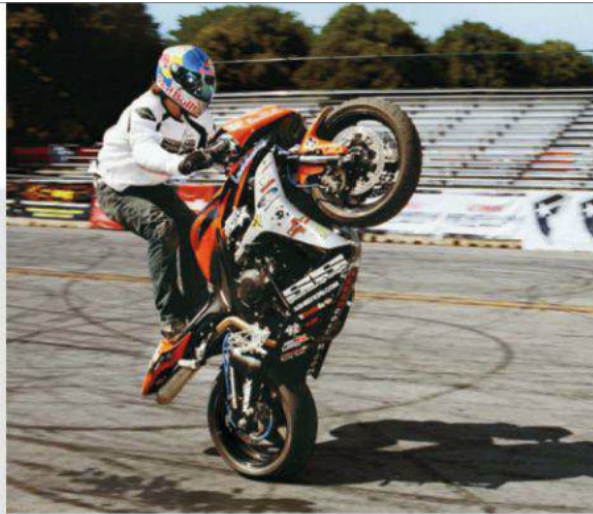
each season. Hundreds of fans have paid \$20 to \$35 to bake in the summer heat and watch a dozen of the world's best stunt riders. They've come to witness such tricks as the highchair wheelie, in which competitors leap onto the motorcycle's front fairing or handlebars while simultaneously twisting the throttle to pop the front wheel into the air, and the switchback elevator, where riders jump from a seated position to stand on the tank—while spinning 180 degrees to face backward.

Colton, of Shakopee, Minn., is considered one of the burgeoning sport's stars. At 20, he has already won an XDL Championship Series and has his own action-figure doll and branded line of motorcycle merchandise. "X Games is mainstream, and stunt riding can become that," he says.

Sportbikes became popular in the 1990s as cheap, dangerous thrill machines. For a few thousand dollars, anyone could go 180 mph, beating Lamborghinis and Ferraris. Riders started doing dangerous tricks, such as popping wheelies on crowded freeways. Stunt crews sold videos of their craziest exploits, which popularized the sport, earned riders lots of money, and cemented the image of stunters as outlaws. "I used to run from cops all the time," Bill Dixon, currently the sport's most dominant rider, says.

Then YouTube killed video sales. At the same time, law enforcement started charging riders with felonies for their reckless behavior, which sometimes resulted in disaster.

Pro stunter Chris "Teach" McNeil, whose Boston-based motorcycle club was named Driving to Endanger after the type of traffic citation members received, remembers those daredevil



**+** *Aaron Colton executes a stand-up wheelie while keeping his bike perfectly balanced. Top riders push wheelies to the limit by doing them in circles with no hands or bringing the bike past its balance point to scrape the tail along the ground. Colton often wins the XDL's wheelie race competition, in which riders pop wheelies, speed down the track at 45 to 60 mph, do a U-turn, and race back—all without the front tire touching the ground.*

*Bill Dixon, 30, is six-plus feet and weighs 195 pounds, making him a giant in a sport dominated by smaller, nimbler men. Dixon prefers high-speed aerial stunts to low-speed acrobatic tricks, though he excels at both.*



days. "We didn't have any safety gear, we didn't know anything," he says. "There were catastrophic failures and deaths and injuries."

Many riders responded by abandoning the streets for parking lots and small competitions, focusing less on all-out speed than on bike control and technique. The XDL Championship Series, created for drifter cars, held its first motorcycle championship in 2007. XDL became the sport's premier league, with five competitions per season and a Nascar-style point system.

With increased competition came bigger tricks and a flurry of bike modifications. Riders guard their engines with metal cages and bore out cylinders for extra power. Stunters sculpt their gas tanks into seats so they can fling their legs over the front fairings, which are rein-





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forced to support the weight. They carve rear seats into footholds and attach extra pegs to the tail, allowing them to climb their bikes like kids on jungle gyms.

Tournaments and cooler tricks have attracted spectators, which has lured corporate advertisers, including Red Bull and Monster Energy. Most sportbike manufacturers—Yamaha, Kawasaki, BMW, Aprilia—sponsor an XDL rider. Kevin Foley is a spokesman for Yamaha, which sponsors Dixon. “We’re kind of a conservative company,” he says. “It took us a while to get involved. But we support XDL. We support getting these guys off the street.”

Tim Buche, president of the Motorcycle Industry Council, agrees. “There was that awkward stage when people were doing a disservice to themselves and motorcycling generally,” he says. “But to XDL’s credit—and tracks that host closed-course competitions with all the proper safety gear—they put on display the amazing skills of the riders and capabilities of a motorcycle. It’s a great show.”

Meanwhile, the stunters’ arsenal of tricks continues to expand. In the past year and a half, riders have discovered that motorcycles can fly. By testing the limits of their bikes at high speeds, they learned how to pull jumps up to 2 feet in the air without using a ramp. Now riders are coming up with new tricks so fast there’s no time to name them all. “Do we call them



aerials? Bunny hops?” Colton says. “We literally don’t have the terminology for it.”

Still, mainstream acceptance and money remain elusive. The winner of each XDL main event earns \$3000. Season winners get no checks, only bragging rights. Riders such as Colton and Dixon, who clinched his record third-straight XDL Championship Series at Indy, make enough money through sponsorships and exhibitions to stunt full time; others have to keep day jobs.

Either way, there’s no real off-season for the stunters. Whenever they can find the time, they keep pushing themselves and their bikes, striving to make the impossible possible. They are driven to stunt and live to compete. “As long as there’s two wheels and a motor, I want to be on it,” Dixon says. “And I want to be winning.” **PM**

## TRICKED OUT

They might look stock, but most stunt bikes are heavily modified to withstand the rigors of stunting and allow for bigger tricks. These are some common mods Aaron Colton (whose bike is pictured here) and other riders make.

On most bikes, the rear brake is operated by a right foot pedal. For added control, stunt bikes have an **extra brake lever mounted to the left handlebar**.

A **steering stabilizer on the handlebars** reduces wobbles when Colton rides a stoppie—which is just like a wheelie but on the front wheel.

Riders sculpt **concave divots into their gas tanks**, which they can use as steps and seats. The divots are covered in rubber for extra grip.

Stunting doesn’t allow for passengers, so **rear seats are carved into footholds** for riders to stand on during wheelies.

Stoppies and aerial tricks are punishing to forks. Some riders use **bulked-up forks designed for racing**; Colton adjusts the springs and valves of stock forks to maximize control.

To reduce lever effort and increase braking precision, stunt riders **double the number of brake calipers** on each wheel.

Stunters tweak their **mufflers and exhaust systems** for lower weight, smooth power delivery, and maximum low-end torque.

Top riders frown upon tail-protecting wheelie bars used by amateurs. Instead, pros use **small titanium plates that throw sparks** when the tail scrapes asphalt.





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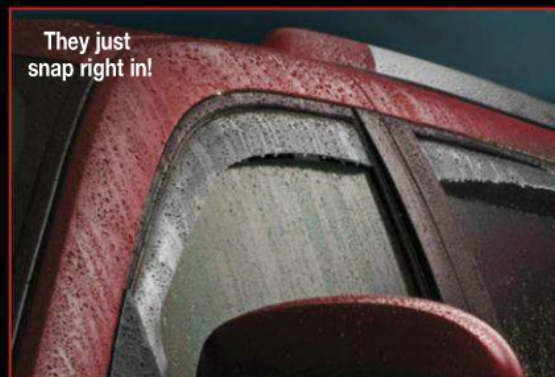
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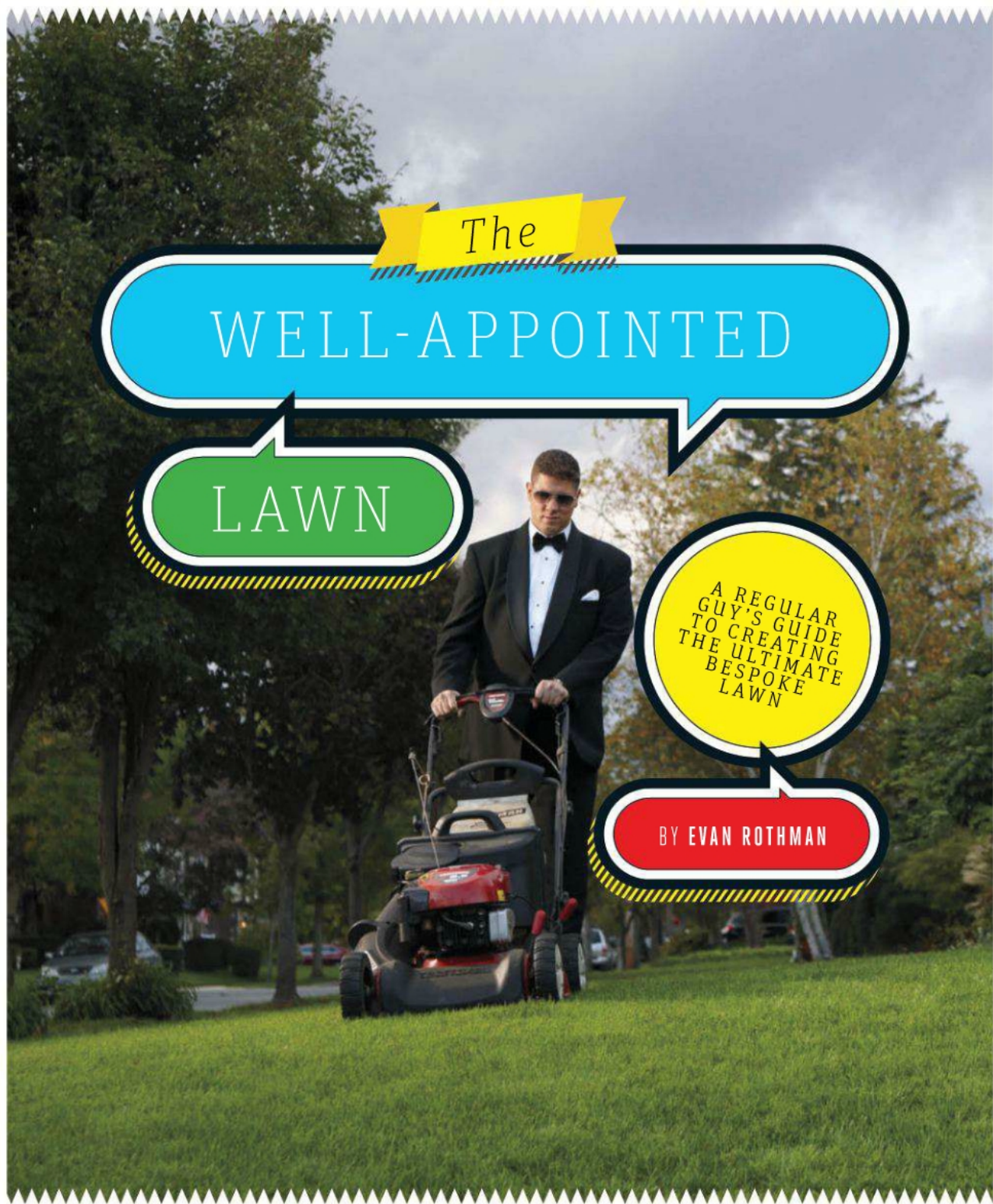
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BY EVAN ROTHMAN

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PHOTOGRAPH BY CHRIS BUCK

A gardener and a gentleman, David Cira, a paramedic with the New York City Fire Department, doesn't normally wear a tux when he cuts grass, but he does know how to give lawns the white-glove treatment. He shares his tips with us, beginning on the right.





# W

**HEN ASKED TO DEFINE A PERFECT LAWN**, Peter J. Landschoot, the director of the Center for Turfgrass Science at Penn State, sounds like a philosophy professor. "There is no perfect lawn," Landschoot says. "It depends on the user's expectations, the lawn's environment, and the owner's sense of aesthetics and lifestyle. It's personal."

Nonetheless, there remains a committed breed of homeowner eager to give perfection a try. Take David Cira, a 32-year-old paramedic with the New York City Fire Department. He grew up in a condo in Queens but spent countless happy weekends at his grandfather's home nearby, where the lawn was always just so. "Nothing thrilled me more than mowing the lawn and helping in the garden," Cira says. "I was good at it from an early age, and it was a passion I never got away from."

Today, Cira maintains his parents' pristine lawn in Mineola, N.Y. He has taught summer adult education classes on turf care, and he has consulted for a landscape designer. To his friends and neighbors, he's an oracle of lawn wisdom. "With a beautiful lawn, you get more out than you could ever put in," he says.

On the other hand, perhaps you've loved your grass but it hasn't loved you back. We understand. We've been there. Lawn enthusiasts like Cira and Landschoot know it's a year-round relationship, not just a summer fling. That's why we worked with them to develop a four-season guide to the perfect lawn.



## Spring

### 1. TEST THE SOIL

For a healthy lawn, you've got to work your way up from the bottom. So start each spring with a soil test. Grass grows best in soil with a neutral pH (about 6.5 on the pH scale) and a region-appropriate amount of phosphorus, nitrogen, and potassium salts, aka potash. "If your soil isn't the greatest from the get-go, you're going to have problems all year," Cira says. You're also going to waste money on fertilizer and other soil amendments that won't work properly because the soil is too acidic or too alkaline. "I know a lot of people who put down lime annually because they feel they should," Landschoot says. "If your soil has a good pH and adequate phosphorus and potassium, all you need to do is put down nitrogen fertilizer every once in a while, which is easy to do and relatively inexpensive." Home soil tests

cost around \$10, but some nurseries do the test for free.

### 2. WAKE UP YOUR LAWN

There is no better way to jump-start your lawn than with a proper mowing and edging. That's a given. In the age-old debate about whether it's better to mow before trimming or trim before mowing, Cira puts himself firmly in the latter camp: "This way you mow your trimmings. It looks neater."

A very dense lawn could

require a spring dethatching.

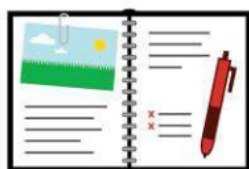
"This will allow the soil to breathe and permit nitrogen exchange with the atmosphere to get the lawn started off in a really good place," Cira says. He recommends buying or renting a power dethatcher (power rake) instead of breaking your back with a manual rake.

### 3. LESS IS MORE

Cira starts his lawn-care year in April, when soil temperature supports growth but before weeds can get a foothold (it may be February in the southern U.S.). He begins work on a six-week lawn-chemical schedule, starting with a typical step 1 product (fertilizer with a pre-emergent

herbicide). Next, instead of the normal step 2 (fertilizer with a weed preventer, or weed-and-feed), he uses a straight fertilizer with high nitrogen content and spot-sprays a separate, selective weed control as necessary. "Weed preventers don't prevent weeds—they kill preexisting weeds—and anytime you add chemicals to the lawn, you stress it," Cira says. "Treat weeds individually. The results are much better, and it's much less expensive."

Don't forget to clean up. Sweep or blow excess fertilizer off walks and driveways and onto the grass; otherwise the chemicals will wash into public waterways.



## BECOME A LAWN JOURNALIST

One of Cira's most effective tools to help him keep a lawn looking consistently pristine is a journal. Starting in the spring, he makes notations about weather and rainfall and takes digital images. He also chronicles the products he uses, and battles fought and won—or lost. You can forget a lot just a month later, and you're certainly likely to forget from one year to the next. For example, if you had a lawn problem and bought a product that didn't work, but two years later the same thing happens, you don't want to waste money on that product again. A journal may seem obsessive, but lawns respond best to obsessive behavior.



## Summer



## BEYOND THE MOWER

ROUND OUT YOUR LAWN-CARE ARSENAL TO SOLVE TOUGH TURF PROBLEMS.



### Difficult Terrain

If you've got a large lawn or one that's bumpy, invest in a better spreader. It's tiring to push a junky spreader with small, solid-plastic tires; a narrow handle; and a balky feed mechanism. It can waste expensive lawn-care products. Buy a spreader with a large handle, pneumatic tires, and, if needed, an edge guard to keep seed, fertilizer, and herbicide where it belongs—on the grass. We show a 7-gallon model by Agri-Fab. It can spread a 10-foot-wide swath in one pass.

### Lawn Junk

It's no fun dealing with sticks, nuts, vines, and especially litter in the course of your lawn care. Consider a no-clog rake like the Ames True Temper model above. It's got rugged, interconnected tines and a sturdy handle.

### Rocky Soil

A tool suited to digging or weeding in rocky soil is one drop-forged from a bar of steel, like the Sneeboer forked weeder above. It's beautifully made and covered by a lifetime guarantee.

**1. WATER WISELY** As temperatures increase, so does lawn stress. Under normal conditions, a lawn needs about an inch of water a week. But when conditions are hot and dry or, worse, hot and windy, you need to add water to replace what has evaporated. Depending on rainfall, you may need to go from watering intervals of every five or six days to every four or five days. Buy yourself a water gauge. It's especially important for homeowners served by municipal water systems, not wells. "A lot of towns have lower water pressure in the summer because of pools and carwashes," Cira says. "Just 5 psi less can equal ½ inch less water per session, so increase its time to compensate."

Water has to have a chance to soak in so it reaches the roots. Each watering session should provide 1 inch of water. Avoid brief watering sessions, which contribute to shallow rooting. For the gearhead there are all manner of toys to eliminate guesswork, such as temperature-sensing weather stations that connect wirelessly to your computer. Yet Cira is partial to simple devices, such as a cup-style rain collector. "The techie stuff can be helpful, but I still like the old-school stuff the best," he says.

**2. TWEAK YOUR LAWN HEIGHT** Top lawn scientists agree that when the temperature rises, so should your grass. Landschoot says a freshly mowed height of 2 to 2½ inches is a reasonable goal. The old "⅓ rule" is still valid: You shouldn't cut more than one-third of the leaf tissue in one mowing. "Every time you mow too low, you're opening up the canopy. This increases weed infestation, since weeds need light to grow," he says. Think of the entire plant system. Tall grass has more plant tissue to hold water, produce chlorophyll, and shade the ground below, keeping it cool and reducing root stress. This also reduces water lost to evaporation, so more is available for the grass.

Cira uses the holidays as a guide to adjust his mower height—up a notch on Memorial Day and again on July 4, down a notch on Labor Day, and back to his starting point by the time Columbus Day rolls around.

**3. BATTLE BUGS** Many homeowners buy a fertilizer with a broad-spectrum insecticide, but Cira isn't a fan. Nationally distributed products are formulated to kill a wide range of common pests, not always those specific to a region. Cira uses a simple organic, low-nitrogen fertilizer and a separate, granular pest control that targets certain bugs. This keeps his lawn healthy while using the least amount of chemicals necessary.



## SOLVE MYSTERY SPOTS

Don't assume a brown spot is caused by a lack of water or the neighbor's gushing Great Dane. A fungus may be to blame, and this can be difficult or even impossible to treat without professional advice. First, take some high-resolution pictures of the blighted areas and share them with your nursery or a university cooperative extension office. Whatever you do, don't just waltz into a nursery carrying a hunk of diseased lawn. Fungal spores that break loose from it can spread. If the nursery says a sample is okay, it will also tell you how to contain it.



# Autumn

## 1. SNATCH THE THATCH

Thatch, a mat of yellowish dead grass that can block air and moisture, needs to be removed. If you slacked on the dethatching in spring, now is the time, but don't go at it too aggressively. If you set the tines too deep on a power rake, you can destroy the lawn. "You're better off making three or four shallow passes, in which you increase the depth of the tines, than going too deep in one pass," Cira says. Likewise, use small flags to mark sprinkler heads to avoid collateral damage.

Don't rent a dirty dethatcher. It's always a bad sign when rental equipment is beat up and dirty, but more so if it's lawn gear. Dirt and debris from a previous customer can spread disease and weed seed from the rental machine to your lawn. Choose your rental center carefully. Look for clean, well-maintained equipment.

## 2. GO TO SEED

True lawn lovers know that early fall is the season to reboot. If you need to reseed, Cira advises using proprietary turfgrass seed, available at nurseries, on the Web, and from landscape-supply houses. Turfgrass breeders constantly improve their seed, and many produce specific regional types. While this seed is more expensive than what's sold at home centers, it's also more vigorous. Cira quotes the old adage that a cheap tool is an expensive tool. "You might pay a few dollars more for a proprietary seed, but the results are tremendous, and you don't have to keep constantly reseeding," he says.

To seed a bare area, Cira tills the soil, applies the seed, and then covers it with a thin layer of lightweight, compost-soil/peat-moss blend. Then he keeps it moist. Once the seeds get dry, they're dry for good.

## 3. TURN OVER A LEAF

Remove leaves—they block sunlight just when grass needs as much light as possible for photosynthesis and root growth. Grass should go from vigorous growth into winter, not enter it weak and underfed.

Even when the lawn is dormant, it needs to eat. You've run the race all summer, now don't fall at the last hurdle. Put the lawn to bed with winterizer (or stage 4 fertilizer) sold at any big-box store. "The potash in it promotes root stability, cold-weather hardiness, and disease resistance, so you get great results come spring," Cira says. "The lawn greens up much quicker."



## PICK UP STICKS

Autumn would be easier if leaves were all that fell, but it's also the season of seedpods, branches, nutshells, husks, and rotten, unpicked fruit that has fallen out of the trees. Careful tree pruning can reduce the problem but not eliminate it. You're going to need something more powerful than your handheld leaf blower to deal with this bulky, prickly mess. Backpack and walk-behind leaf blowers are far better than handheld blowers for moving difficult debris off the lawn or at least into piles that can be gathered. If you can afford it, consider a pro-quality lawn vacuum (typically \$900 to \$1500).



## Winter

## STAKE YOUR CLAIM

Don't let nine months of obsessively hard work get wrecked once the snow falls. Stake the perimeter of your driveway and walks to reduce gouging by snow throwers and plows. Reduce the use of de-icing chemicals to the minimum amount required to do the job. Excess de-icer can burn grass.

**1. HIT THE BOOKS** You finally have a little breather. Take some final notes and start poring over your journal. It's as important to study what went wrong as what went right. Visit sources online. "Look for information based on research, and try to stay with local sources," Landschoot says. "Grasses are managed differently in different parts of the country. I'm obviously a biased source, but university websites are a good place to start." Universities with turf-care and horticulture programs and cooperative extension services often post weed-identification pictures online. If you know your enemy, what prompts its growth, and what it's vulnerable to, the battle is halfway won.

**2. PREPARE FOR SPRING** Now is the time to clean and repair equipment. Remove grass clippings and dirt that hold moisture, which can cause rust. Cira even disinfects under the mower deck using a dilute 10:1 water-bleach solution followed by a rinse.

Next, remove the spark plug and air filter on four-cycle and two-stroke machines. Drain and replace the engine oil on four-cycle equipment, and sharpen or replace the mower blade. Clean the string-trimmer head and wind fresh line on it. Finally, install a new, properly gapped spark plug in your mower, trimmer, and blower.

Generously lubricate cable linkages and pivot points with spray oil. Pump grease into fittings, and replace drivebelts if they've reached the number of hours of service life recommended by the manufacturer. When in doubt, just replace them.

**3. ADD GOOD FUEL** The first rule of winter storage is to do what the manufacturer of your equipment recommends. Owner's manual instructions trump anything we or anybody else has to say. If the manufacturer tells you to run your equipment dry and store it over the winter that way, so be it. If, on the other hand, it advises putting it to bed with a full fuel tank, that's what you need to do.

The most important thing to know is that today's ethanol gasoline decomposes quickly in storage. It can damage or even ruin equipment, especially when the equipment sits around over the winter. Add fuel stabilizer to both four-cycle and two-stroke fuel mix. This prevents the chemical-decomposition process. **PM**



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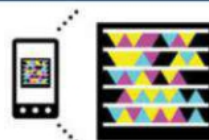
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DIY

# Tech

## Digitizing Home Movies

DON'T LEAVE YOUR MOST IMPORTANT VIDEO MEMORIES STRANDED IN A BOX IN THE BASEMENT.

BY JOHN HERRMAN

➔ **As video content gets old**, it gains sentimental value. As film and video media get old, they fall apart. This is the paradox at the center of our movie collections: It's the priceless images—the first steps, the trips down the aisle—that have greatest risk of loss.

Reel-to-reel 8-mm tape has a typical shelf life of about 20 years, at which point the threat of magnetic instability, tape deformation, and general chemical breakdown becomes unavoidable. Likewise,

INSIDE

X DEAD BATTERIES + PHANTOM FILES + PIRACY PEEVES



## DIY Tech DIGITIZING VIDEO

VHS cartridges begin to deteriorate after only a decade. Recordable CDs and DVDs, despite their apparent durability, can fall prey to oxidation after just a few years—data is stored on a delicate metal film at the top of the disc, not in the plastic.

Hard drives and solid-state storage won't last forever either, but at least they give you control. With your movie collection stored on a computer, it joins a maintainable mass of data, part of your ongoing computing experience. Once in the digital realm, movies can be copied and recopied. They can be uploaded to the cloud. Most importantly, they can be backed up.

## From the Attic to the Hard Drive

➔ **Before you get started** digitizing, you'll need to assess the scale of your project. Digitizing tape or film is a real-time process; it takes as long to convert it as it does to watch it. Digitally archiving more than a dozen hour-long videotapes or more than a few reels of 8-mm film is a big undertaking, so if you're facing boxes and boxes full of dusty film, you might need to get professional help.

Services such as DigMyPics and Digital Memories will digitize a variety of film and videotape formats, including 8-mm, for a rate of about \$20 per transfer. This can quickly get expensive, but you're paying for more than just speed and ease—these companies are well-equipped to deal with delicate, volatile old media. They also have well-maintained playback and recording equipment designed to tolerate imperfection and deal gracefully with failure. DigMyPics, for example, scans each reel frame by frame, projecting light through the film and onto a specially designed image sensor, ensuring consistent transfer quality. So if your home videos are both old and priceless and you haven't viewed them in years, you should err on the side of caution; not only are your reels and cassettes weakened by age, but your vintage playback



KNOW YOUR STUFF

## VIDEO PLAYBACK 101

You don't spend hours converting old videos just to leave them languishing on a hard drive. Here are four ways to watch your new digital home-movie collection.

PS3



**Plays** > H.264, MPEG-4, DivX. **Special talents** > Compatible with the .mkv format, which is common for HD video.

IPAD



**Plays** > H.264, MPEG-4, Motion JPEG. **Special talents** > Streams media from a PC with an app called StreamToMe.

XBOX 360



**Plays** > H.264, MPEG-4, Windows Media. **Special talents** > Connects to any Windows PC with Windows Media Center.

SMARTPHONE



**Plays** > H.264, MPEG-4. **Special talents** > Streams video from PCs running a free app called TVersity, even over 3G.

hardware probably isn't at its best either.

That's not to say you can't digitize tape and film yourself. If you know your home movies to be in decent shape and your playback hardware is in working order, digitizing personal video is a uniquely gratifying personal project. Think of it less as a chore than as a chance to revisit your life's greatest stories.

## Digitizing Film

➔ **Low-tech storage media** call for a low-tech conversion technique. As a consequence of their design, reel-to-reel projectors' only output is the projection itself—there are no ports to plug anything into, just the projected image. The process of digitizing old film, then, is really an act of rerecording.

Set up your projector in a dark room, and make sure your projection surface is smooth, white, and no more than a couple feet wide—a closer projection will ensure sufficient brightness and full-color reproduction. (If you don't have a projector, there's a steady supply of sub-\$100 variable-speed models on eBay.) Set up a digital video camera—an HD flip-style cam or even a high-quality smartphone camera will do—and position it on a stable surface close to the side of the projector. Begin recording some sample footage.

It's likely that you'll notice some flickering in the image; this can be remedied by adjusting the speed of the projector. The perspective of the film will be slightly skewed, of course, but the effect can be minimized by cropping the frame slightly. If you are recording directly from a projector's speaker rather than via its line output, check that your camera's mic isn't picking up too much mechanical noise.

The resulting footage should be clean and vivid but not necessarily without quirks. Nearly all video cameras, especially cheaper ones, meter light automatically and continuously, so the image may suffer from brief moments of overexposure. If you can manually adjust your camera's exposure, setting it to a fixed exposure is ideal.

As with reel-to-reel film, the digitization process for VHS and most tape-based media calls for both old and new equipment. For this intergenerational marriage, you'll need an analog-to-digital converter (ADC). Among the most affordable and reliable



ADCs is the Elgato Video Capture dongle, a squid-like USB accessory, which can be found online for under \$100. It lets you connect older playback equipment—VCRs, camcorders—to your computer.

After you connect the Video Capture cable to your computer and video source, you'll find the recording process is highly guided. Elgato's software will prompt you to adjust the recording parameters to your liking (the H.264 video format in standard definition is generally fine) and then ask you to hit Play on the video source. When the recording is finished, you'll have the option to export files to iTunes or Windows Media Player. Instead, simply save them to a folder. You'll still be able to play the files in your media player of choice, but this way they won't get hidden deep in your computer's file system where they might get lost or be forgotten.

Archiving, or "ripping," DVD video is a three-click process. A free application called HandBrake, available for both PC and Mac, will automatically recognize a DVD video when the disc is inserted into the computer. Before clicking Start, select the Normal quality setting under the Regular tab on the right side of the app. The rip and conversion should take between 5 and 30 minutes and will produce an archival-quality H.264 video file. To estimate your storage requirements, assume you need about 75 megabytes for every 10 minutes of SD footage, and 125 megabytes for every 10 minutes of HD footage. The cost of storage has fallen below \$0.10 per gigabyte, down from about a dollar in 2005. One-terabyte external hard drives can be purchased from Amazon for well under \$100.

HandBrake is also useful for converting digital video recordings in less common formats—like Sony's and Panasonic's AVCHD—to an H.264-based .avi file, a format that will likely be far better supported into the distant future. (H.264 also plays well with current gadgets from smart TVs to smartphones.) Make sure to change HandBrake's conversion settings to HD for newer digital video, otherwise you'll lose video quality.

## Saving for the Future

☛ **By the time you've finished** digitizing your videos you'll have amassed a folder full of files. Capturing the video is the hardest step of the archiving process, yes—but it's not the last.

Long-term video storage in the digital age is fundamentally new. The University of Southern California Shoah Foundation Institute, which maintains a collection of more than 51,000 historically invaluable video testimonies by Holocaust survivors, recently converted its library from tape to digital video; 234,000 tapes were fed through dedicated digitization stations, converted to digital video, and sent to be stored in a facility that looks more like a Google data center than a library. Though USC's project was far bigger than any of ours, its procedures are instructive: The university didn't just digitize its video, it backed it up.

Backing up video doesn't necessarily mean buying a stack of new hard drives or a dedicated backup system such as Apple Time Capsule. It's really just a matter of duplication: You haven't really archived your video until you've made two independent copies of it. For newly converted videos, that can mean a number of things. You can simply store your video files on both your computer's hard drive and an external USB hard drive. Or you can upload your video files to YouTube or Vimeo, where they can be designated as Private.

Should one hard drive fail, you can immediately copy your videos to another. If, say, Google decided to shut down YouTube—remember, we're thinking long-term here—you can redownload your videos from the site, upload them to another, or save them locally. This ongoing process guarantees more than peace of mind—it means that for the rest of your life, your video will be as easy to watch as it is safe. **PM**

### LAB TEST

## HOW FAST IS THUNDERBOLT?

✕ Apple introduced the Thunderbolt port in 2011, but only now are we seeing a large-scale rollout of Thunderbolt peripherals. Apple says the standard is up to 20 times faster than USB 2.0. But that's a theoretical number. How fast is it in the real world?



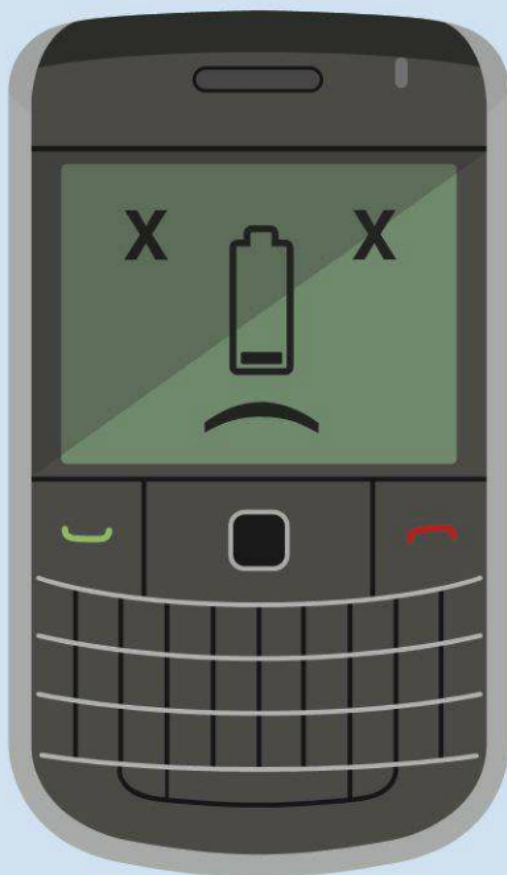
**TEST:** We transferred a 2.7 GB movie file from an SSD-equipped MacBook Air to the drive over USB 2.0 and Thunderbolt. Then we transferred the same file using a PC with an internal SSD and a USB 3.0 connection.

**RESULTS:** Thunderbolt is fast, but nowhere near as fast as Apple claims. Our test file took 84 seconds to transfer from our MacBook Air to our GoFlex drive over USB 2.0. That same file took 33 seconds over Thunderbolt. Despite USB 3.0's lower speed rating (purportedly 5 gigabits per second), the file transferred in 35.2 seconds—close to parity with Thunderbolt.

**VERDICT:** Until the cost of the equipment comes down—the \$50 cable is not included—Thunderbolt is absolutely not worth the price unless you're routinely transferring truly huge files.

—GLENN DERENE





## Digital Clinic

by John Herrman

### Battery Death

I'd like to give my old phone to a friend, but when I pulled it out of storage, the battery was completely dead. It was fine when I put it away. What happened?

**A** Lithium-ion batteries are the problem child of modern electronics. They leave your laptop juiceless after just a few hours. They send you hunting for power outlets at the least opportune times. They're the reason "sorry, my phone's about to die" has become as common a sign-off as "goodbye" in modern cellphone conversations.

Less obvious than low capacity is the problem of longevity. Lithium-ion and even newer lithium-polymer batteries have a nasty habit of losing capacity over time or, worse, dying altogether.

Any battery issue is by definition a chemistry problem. In a healthy battery, ions flow freely between a cathode and an anode. Charging a battery forces ions from the cathode to the anode; using the battery reverses the flow.

Over time, this process wears out the cathode, which results in reduced capacity. A high-end lithium-polymer battery can lose about 20 percent of its capacity after 1000 charge cycles. Another way to think of this is to imagine that every time you recharge your laptop, you shave a few seconds off its maximum battery life. Erratic charging and heat speed up this degradation.

And batteries degrade even if you don't use them. According to battery-testing firm Cadex Electronics, a fully charged lithium-ion battery will lose about 20 percent of its capacity after a year of typical storage. Increase the temperature to just above 100 degrees Fahrenheit—as in a hot attic, for example—and that number is 35 percent.

On the other hand, an *empty* battery pack can eventually fall into "deep discharge," at which point the battery's protection circuit—intended to prevent power from reaching defective battery cells—is triggered. This leaves the battery unable to charge at all.

Your best bet for long-term battery storage is to run the charge down to 50 percent, remove the battery from the device, and keep it cool. But even ideal storage conditions can leave you with a dead battery after three or four years.



## Trash Talk My computer tells me that I'm running low on disk space. I've deleted files, but the messages won't stop.

By default, "deleting" a file moves it to either the Recycle Bin (Windows) or the Trash (Mac OS). In other words, the files haven't been deleted—they've been sent into limbo, to a special folder where they remain fully intact but can't be directly accessed. This is a blessing when you realize you've accidentally deleted an important file. More often, though, it's just a waste of space.

Going forward, to free up hard-drive space, right-click on the Recycle Bin or Trash icon and click Empty. Windows users can bypass the Recycle Bin by selecting a file, holding down Shift, and pressing the Delete key.

## Abandon Ship? I have a hunch my kids are pirating music, and I want them to stop. They claim it's no big deal. Should I worry?

In 2008, the Recording Industry Association of America announced that it would be drawing down its lawsuits against file sharers, instead relying on Internet service providers to issue warnings. This gave some the impression that file sharing has become, if not legal, safe. It hasn't.

Hosting and sharing copyrighted materials for free is still illegal, and looser enforcement doesn't change the fact that file sharers' identities are exposed.

BitTorrent, a popular file-sharing service, exposes users' IP addresses to whoever might want to see them, be they copyright holders or law enforcement. Free download sites such as MediaFire are themselves vulnerable to lawsuits, which could result in the sub-

poena of user information—the biggest, Megaupload, was shut down by authorities in January. Getting slapped with a hefty lawsuit for downloading files may be statistically unlikely, but it's not impossible.

I suggest an unorthodox remedy: Next time your kids' birthdays come around, get them a subscription to one of the many all-you-can-listen music services such as Spotify or Rdio. They won't pirate music if they don't feel like they need to. **PM**



TECH TACTICS

### THE FLASH-FREE LIFESTYLE

With the rise of HTML5 video and native Web apps, Adobe's Flash browser plug-in is on its way out, and not a moment too soon. Here's how to switch off—but not permanently delete—this buggy, insecure, resource-hungry software.

#### FIREFOX

Download an extension called Flashblock from [addons.mozilla.org](http://addons.mozilla.org), click on Install, then restart the browser.

#### CHROME

Click on Preferences, Under the Hood, Content Settings, Manage Exceptions, and Disable Flash, then restart the browser.

#### IE 9

Click on Tools, Manage Add-ons, and Shockwave Flash, then select Remove All Sites.

#### Got a technology problem?

Ask us about it. Send your questions to [pmdigitalclinic@hearst.com](mailto:pmdigitalclinic@hearst.com). While we cannot answer questions individually, problems of general interest will be discussed in the column.



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DIY

## Home

## Task Masters

OSCILLATING TOOLS DO ALMOST ANY JOB—AND THEY'RE FASTER AND CHEAPER THAN EVER. WE TEST THE BEST. BY ROY BERENDSOHN

✚ If there's another device that does everything as well as an oscillating tool, I'd like to see it. These tools cut, plunge-cut, flush-cut against a surface, grind, sand, remove grout, scrape out caulk and crumbling window putty, and work in tight spots that are inaccessible to other power tools. They accomplish this with a fine, high-speed oscillating motion that gives you impressive control without kickback and with little vibration. A wide range of odd-looking saw blades, grinding discs, and sanding pads can be used with the tool. And the price of these attachments has fallen dramatically in the past couple of years, as has the cost of the tools themselves.

We gathered nine corded oscillating tools and went to work, sawing through door trim, grinding away thin-set mortar, slicing through grout, and sanding away paint, putting a stopwatch to our results when we could and just running flat out when we couldn't. We had a blast. But we always do when we're testing tools. Here's our report.



INSIDE



DEALING WITH RUNOFF + CAMPSTOOL + FUTURE-PROOF GARAGE



DIY

## Home OSCILLATING-TOOL TEST

**BOSCH MX25E**

Price:  
**\$160**

Weight:  
**3.75 pounds**

Decibels (C):  
**83**

Amps:  
**2.5**

Cord length:  
**8 feet 5 inches**

The Bosch is solid and about as fast and powerful as its esteemed orange competitor, the Fein (our other top performer). Designers wisely equipped the tool with an extremely gentle soft-start feature that helps you maintain control when you're working in an awkward position, making the kind of tough cut these tools are intended for. Another good move: They included a universal adapter plate, so you can use most of the accessories available from other companies.

**Dislikes:** The model we tested did not have tool-free accessory mounting, unlike the Fein. A new version, the MX30E (\$200), corrects that deficiency; our advice is to choose that one.

**FEIN FMM250Q**

Price:  
**\$200**

Weight:  
**4 pounds**

Decibels (C):  
**89**

Amps:  
**2.08**

Cord length:  
**16 feet 5 inches**

Run the Fein and you know you're operating a high-quality power tool. This thing is basically a powerful motor, dense with copper windings, and a giant power cord. That's why we love it. The tool cuts and grinds flawlessly and with no vibration. Its unique tool-free mechanism lets you firmly snap its accessories in and out in seconds. And the accessories themselves are flawless. We can't assess durability, but our hunch is this German-made tool will provide tank-like longevity.

**Dislikes:** As fine as the Fein is, its abrasive pad loaded up during the paint-removal test. We tried the task at various speeds but still found loading to be a problem.

**CHICAGO ELECTRIC 67537**

Price:  
**\$50**

Weight:  
**2.95 pounds**

Decibels (C):  
**90**

Amps:  
**2.0**

Cord length:  
**6 feet 8 inches**

We were impressed by the power of this budget-friendly tool. It removed grout and thin-set mortar almost as quickly as the Fein and the Bosch. Although it didn't saw as fast as either, it's still a respectable cutter.

**Dislikes:** The metal backing plate on the sanding pad should be offset from the pad, not flush with its edge. The plate wears a groove into the adjacent vertical surface when sanding in corners. That's bad.

**CRAFTSMAN 320.23465**

Price:  
**\$80**

Weight:  
**2.71 pounds**

Decibels (C):  
**86**

Amps:  
**2.0**

Cord length:  
**8 feet 9 inches**

The Craftsman has a nice little worklight on its nose and a well-positioned speed-adjustment dial. We also appreciated its long power cord. Small details like that add up on a power tool, especially one that's intended for use in uncomfortable positions and doing tiring jobs in odd places, such as inside cabinets. It cuts and sands adequately and cleans up nicely after itself with a dust-collection tube that slides firmly into the handle.

**Dislikes:** Could use a bit more power.



**DREMEL MM40**

Price:

**\$140**

Weight:

**3.25 pounds**

Decibels (C):

**89**

Amps:

**2.5**

Cord length:

**6 feet 8 inches**

Dremel made its name with rotary tools that are still the industry standard, so it makes sense that it would go after another niche machine like the oscillating tool. If you're already a Dremel fan and want something to pick up where your rotary tool leaves off, you won't be disappointed. The Dremel racked up favorable times in cutting, sanding, and grinding, but what helps set it apart is the lack of vibration it transmits to the user.

**Dislikes:** Not that the Dremel lacks power, but just adding a bit more would vault this tool into the five-star category.

**PORTER-CABLE PC250MT**

Price:

**\$140**

Weight:

**3.45 pounds**

Decibels (C):

**88**

Amps:

**2.5**

Cord length:

**10 feet**

One of the chief benefits of oscillating tools is that they let you go quickly from job to job. The Porter-Cable had the best tool-free accessory mounting. It allows quick swaps from blade to blade or among sanding and grinding functions—just push down on the big lever below the drive shaft, slip out one accessory, and slip in a new one. Add very good power plus a reasonable lack of vibration and you've got a winning combo for your next tool purchase.

**Dislikes:** Given how capable this tool is, we were disappointed that a carbide-faced grinding disc is not included in its kit or even offered as an accessory. You need one of these for surface grinding.

**RIDGID R28600**

Price:

**\$130**

Weight:

**3.2 pounds**

Decibels (C):

**92**

Amps:

**3.0**

Cord length:

**8 feet**

We'll give Ridgid credit for bravely blazing its own trail. This is not really an oscillating tool; it's a motorized handle that takes an oscillating toolhead and other accessories, such as a jigsaw. It offers satisfactory performance, but not hardcore oscillating-tool chops.

**Dislikes:** The large paddle on/off switch controls motor speed but doesn't have a lock button; thus, the tool is uncomfortable and tiring to use. Despite drawing more amps than its competitors, the Ridgid is not particularly powerful.

**ROCKWELL RK5102K SONICRAFTER**

Price:

**\$160**

Weight:

**3 pounds**

Decibels (C):

**94**

Amps:

**2.3**

Cord length:

**10 feet**

This beefy little rascal did very well sanding and grinding and is an adequate cutter. A low-profile slip-on chute helps it pull dust into a shop vacuum, limiting the mess it creates. Most of its backing pads and abrasives are perforated to enable this.

**Dislikes:** We're not sure why, but compared with its competitors, the Sonicrafter was noticeably loud.

**SKIL 1400-02**

Price:

**\$80**

Weight:

**2.8 pounds**

Decibels (C):

**92**

Amps:

**2.0**

Cord length:

**6 feet 7 inches**

Skil didn't skimp on this tool's motor and drivetrain. It sliced nicely through door trim and plywood and worked with respectable speed when sanding away paint. The tool's other benefits include a narrow profile at its tip and plentiful overmold at the front and back. Those ergonomic details make it comfortable to grip when sanding or performing any other job.

**Dislikes:** The motor Skil didn't skimp on, but the accessories it did. The kit comes missing the obvious, such as carbide-grit tools to help remove mortar and grind away grout.



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Item 90899 shown

ITEM 90899/98025/69096 REG. PRICE \$9.99

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**12 PIECE CUSHION GRIP SCREWDRIVER SET PITTSBURGH**

LOT NO. 68868/69421

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**SAVE 58%**

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**6" DIGITAL CALIPER PITTSBURGH**

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**WIRELESS DRIVEWAY ALERT SYSTEM Bunker Hill Security**

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**SAVE 53%**

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**SAVE 68%**

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**500 LB. CAPACITY ALUMINUM CARGO CARRIER HaulMaster**

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**SAVE \$57**

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**580 LB. CAPACITY FOUR DRAWER ROLLER CART US\*GENERAL**

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**4-1/2" ANGLE GRINDER**  
drillmaster  
LOT NO. 95578

Grinding wheel sold separately.

**SAVE 50%**

**\$9<sup>99</sup>**

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64510274

**SUPER COUPON!**

**MOVER'S DOLLY**  
HaulMaster  
LOT NO. 93888

**SAVE 46%**

**\$7<sup>99</sup>**

REG. PRICE \$14.99

1000 LB. CAPACITY

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43843729

**SUPER COUPON!**

**8-IN-1 SOCKET WRENCHES**  
PITTSBURGH  
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**SAVE 40%**

**\$8<sup>99</sup>**

REG. PRICE \$14.99

SAE LOT NO. 65498  
METRIC LOT NO. 65497

YOUR CHOICE!

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64006772

**SUPER COUPON!**

**AUTOMATIC WRIST BLOOD PRESSURE MONITOR**  
WristTech  
LOT NO. 67212/97742

Requires 2 AAA batteries (sold separately).

**SAVE 53%**

**\$13<sup>99</sup>**

REG. PRICE \$29.99

Item 67212 shown

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2152321097

**SUPER COUPON!**

**80 PIECE ROTARY TOOL SET**  
CHICAGO ELECTRIC POWER TOOLS  
LOT NO. 97626/68986

**SAVE 70%**

**\$7<sup>49</sup>**

REG. PRICE \$24.99

Item 97626 shown

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24688702

**SUPER COUPON!**

**FLUORESCENT WORK LIGHT**  
CHICAGO ELECTRIC POWER TOOLS  
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**SAVE 33%**

**\$9<sup>99</sup>**

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**SUPER COUPON!**

**3 PIECE TITANIUM NITRIDE COATED HIGH SPEED STEEL STEP DRILLS**  
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**SAVE 55%**

**\$8<sup>99</sup>**

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62711292

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**18 VOLT CORDLESS 3/8" DRILL/DRIVER WITH KEYLESS CHUCK**  
drillmaster  
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**SAVE 43%**

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3-5 hour charger, AC/DC wall adapter, battery included.

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**SUPER COUPON!**

**DIGITAL INSPECTION CAMERA WITH 2.4" COLOR LCD MONITOR**  
CENTECH  
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**10 FT. x 10 FT. POPUP CANOPY**  
NFT  
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219770380332

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**90 AMP FLUX WIRE WELDER**  
CHICAGO ELECTRIC  
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315116496

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**3 GALLON, 100 PSI OILLESS PANCAKE AIR COMPRESSOR**  
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2733303293

**SUPER COUPON!**

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THUNDERBOLT solar  
LOT NO. 90599/68751

**SAVE \$80**

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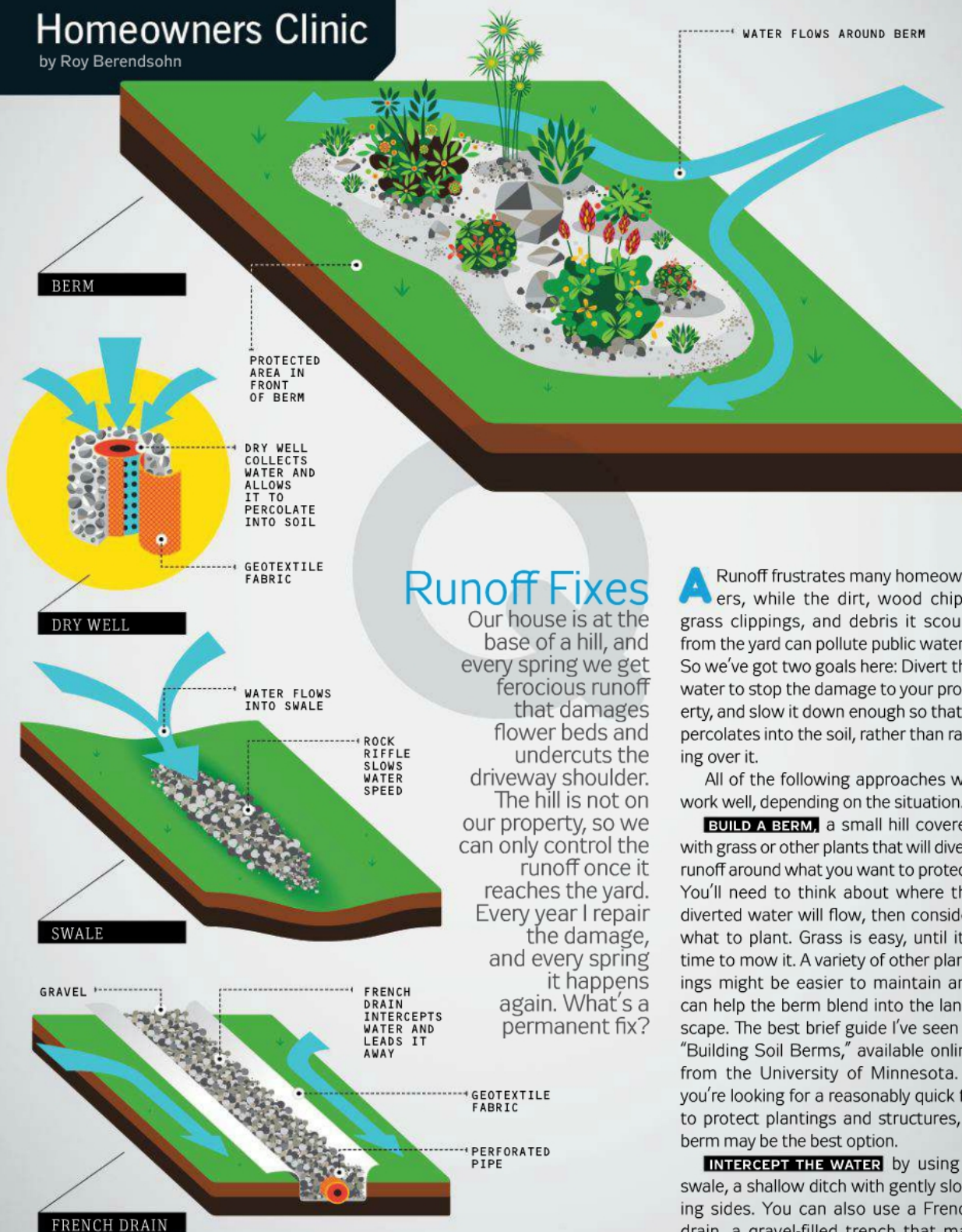
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# Homeowners Clinic

by Roy Berendsohn



## Runoff Fixes

Our house is at the base of a hill, and every spring we get ferocious runoff that damages flower beds and undercuts the driveway shoulder. The hill is not on our property, so we can only control the runoff once it reaches the yard. Every year I repair the damage, and every spring it happens again. What's a permanent fix?

**A** Runoff frustrates many homeowners, while the dirt, wood chips, grass clippings, and debris it scours from the yard can pollute public waters. So we've got two goals here: Divert the water to stop the damage to your property, and slow it down enough so that it percolates into the soil, rather than racing over it.

All of the following approaches will work well, depending on the situation.

**BUILD A BERM.** a small hill covered with grass or other plants that will divert runoff around what you want to protect. You'll need to think about where the diverted water will flow, then consider what to plant. Grass is easy, until it's time to mow it. A variety of other plantings might be easier to maintain and can help the berm blend into the landscape. The best brief guide I've seen is "Building Soil Berms," available online from the University of Minnesota. If you're looking for a reasonably quick fix to protect plantings and structures, a berm may be the best option.

**INTERCEPT THE WATER** by using a swale, a shallow ditch with gently sloping sides. You can also use a French drain, a gravel-filled trench that may



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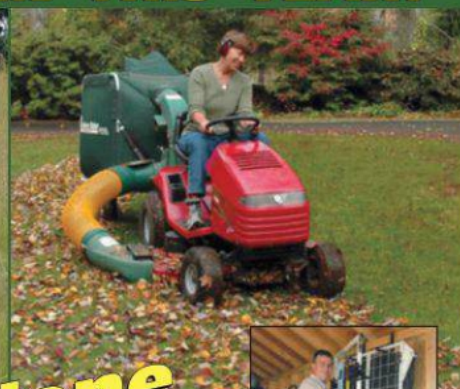
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DIY

## Home HOMEOWNERS CLINIC Q+A

have a perforated pipe at the bottom. New products include the EZ-Drain, which consists of a perforated pipe and plastic beads encased in a tube of landscape fabric. The fabric surrounds the pipe like a sock and prevents dirt from infiltrating and filling up the pipe or the air spaces between the beads. Because French drains handle water that is moving not just over the soil but through it, they're the best solution for keeping water out of a basement.


**ROUTE THE WATER INTO A DRY WELL** As the name suggests, this is a hole in the ground that remains dry most of the time. However, when water is flowing, it can be routed to the well by a swale or roof downspout. Dry wells are particularly helpful in a spot where downspouts are flooding a large paved area or when you're coping with runoff from a large roof. Finally, you can dig a dry well in any low area where a big puddle tends to form.

**GRADE BROAD SURFACES** to direct runoff away from houses, sheds, barns, and patios. In most cases this requires a professional excavator or expensive rental equipment. But it's almost always an essential step for correcting a flooded basement or crawlspace.

**REPLACE IMPERMEABLE SURFACES** such as concrete with permeable pavers and gravel. This can be expensive, but it's worth considering, especially if you're already replacing deteriorated asphalt or concrete.

A final word of advice is in order before you start swinging a pickaxe or renting a Bobcat loader. Many parts of the country are enacting strict rules about landscape modifications that affect groundwater, even on a small scale. While these regulations are more likely to apply if your house is close to a lake, stream, or seashore, it pays to check permit requirements no matter where you live.

It's also smart to make use of your state's One Call service before you dig. Dial 811 and you'll be directed to your local One Call Center, which notifies utilities in your area of your intent to dig. These companies will send crews out to spray-paint or flag the location of buried utilities, such as telecom cables, gas lines, and sewers. You think runoff is a problem? Try rupturing a gas line.

**Steel Trap**  I helped my son with a metalworking project after he got a tap stuck in a hole. We eventually removed it, but when I tried the tap, the same thing happened. I know the drill bit is the right size because we bought it and the tap as a matched pair. We used lubricant, but it didn't seem to help. Ideas?

A tap is a tool that cuts threads in a hole for a bolt or a machine screw. It's very useful but occasionally frustrating. A number of things can cause it to stick in the hole and even break off: using too much force to start it, starting it crooked, being stingy with the lubricant, or choosing the wrong kind of lubricant.

Let's review the basics. First, use the right-size bit. In this case, that's not a problem since you bought a matched set. In some cases, you may buy a tap on a hang card that lists the correct-size drill bit. Otherwise, consult a tap-and-drill chart or look carefully at the shank of the tap, which may list the bit size. If you're using a bit you already own, make sure it's sharp enough to leave a clean, round hole. After you drill the hole, flush out metal particles with an appropriate cutting lubricant, such as Rapid Tap. (Don't use compressed air. That's dangerous because it sends metal shavings flying.) Put a bevel—more properly called a chamfer—on the hole's rim.

Now, with both the hole and the tap lubricated, run the tap into the hole so it starts cutting threads. Be sure the tap's long axis is parallel to the hole's. Rotate the tap firmly clockwise and then make a partial counterclockwise turn to break off the metal shavings it produces. Back out the tap after it has cut about halfway down, and flush metal particles from the hole with lubricant.

Note that the material you're tapping may be causing problems for you. Mild steel is the easiest metal to tap, but if you're working with aluminum, cast iron, or hardened

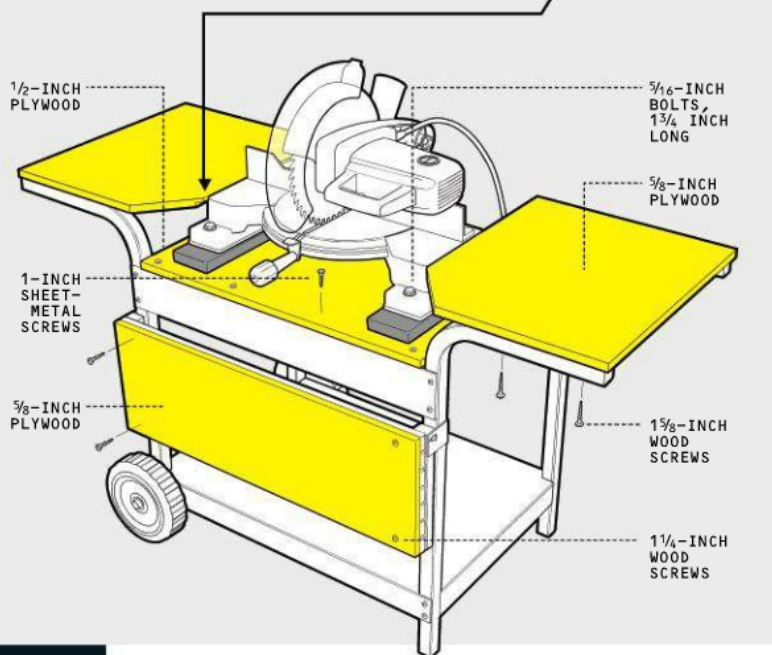
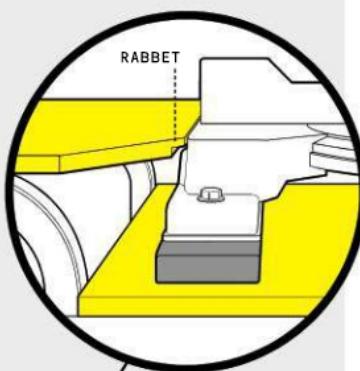




THE RECYCLER

## MITERS À LA CART

➔ **Randy Dean runs a tight shop** in his home in Ignace, a town of 1700 people—many of them loggers—in Ontario. Dean's work space is well outfitted for everything from welding to woodworking. He has always owned a miter saw, but something about it bugged him. It just sat there. Putting the saw on wheels would improve its utility—almost anything is better on wheels—and it would be easy to do. Dean started with an old barbecue cart and ended up with a rolling miter saw. Now, that's a mobile device.



### HOW TO MAKE IT:

Strip off the barbecue body, its plumbing, and the control panel. Rip and crosscut 1/2- and 5/8-inch plywood panels to make a base and extension wings to flank the saw.

The top of the saw's table should be flush with the extension wings, so you'll need to cut

wood blocks to position under the saw to raise it up. Cut the blocks to size, place them beneath the saw, mark and drill the mounting holes in the blocks, and bolt the saw through the table to the cart. You may also need to cut a rabbet in the wings to let them fit neatly over any projections

in the saw body.

Next, attach the wings to the cart's sheet-metal tubing using 15/8-inch wood screws. If your cart is equipped with a slatted shelf on the front, you might opt to keep it. Dean screwed a piece of plywood over the slats to provide an additional work surface.

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steel you need specialized equipment. All of these materials require professional-grade taps, careful hole sizing, and more attention to detail.

Finally, people often run into trouble with deep holes, especially those that don't go all the way through the metal. Here's a rule of thumb: When the hole is deeper than three drill-bit diameters, use spray lubricant to flush out the hole as thoroughly as possible. And, if the hole doesn't go all the way through the metal, make sure to use a bottoming tap to cut threads into it.

## Fast Flooring ➔ Are peel-and-stick floor tiles any good?

Sure, peel-and-stick vinyl tiles are a great product and very DIY friendly. You can reliably install them on top of plywood or, with some precautions, on concrete. If you're working with plywood, make sure it's rated for use as a subfloor. How would you know? The plywood will have a grade stamp on it from the Engineered Wood Association that says so. If the subfloor is rough lumber or is plywood that lacks the rating, or if you're not sure what kind of plywood it is, then install subfloor-rated plywood.

The tricky thing about concrete is that any moisture vapor or groundwater that comes through will lift the tiles. As a test, use plastic tape to seal an 18 x 18-inch piece of clear plastic sheet to the floor and leave it in place for 24 hours. If you see condensation on the underside of the plastic, you can't install the tiles on the floor. If the plastic stays dry, the tiles will probably work. No guarantee, though.

## Future-Proofing the Garage ➔ I'm planning to bury the power lines that run to my detached garage. I'm also adding Cat 6 network cable. What's the best way to run these cables and do some future-proofing while I'm at it?

Most of the decisions will be made for you by the local building code. Before you head down to town hall to pick up a permit, see whether the municipality has posted construction tips online. If so, you'll probably find that they are based on some version of the National Electrical Code (2011 NEC, Table 300.5).

So your installation will have to meet the NEC rules, or the town's take on them. Given that you're concerned about future-proofing your garage, install PVC conduit—that's conduit, not PVC plumbing pipe. Use one for power and a separate one for your Cat 6. This will meet your present needs while letting you replace or modify the setup in the future. To protect the conduit from damage, bury both of them at a depth the town specifies (from 4 to 24 inches, depending on a range of variables).

It's especially important to get the details right with electrical conduit. Installing LB fittings will make your life easier. (The L in LB stands for Elbow; the B stands for Back, which is where the mounting hub exits the fitting.) These fittings, which look something like a periscope, will help you turn the corner from the conduit riser into the garage. Also, an LB fitting has a removable hatch that makes it easier to pull the cable. And be sure to use primer and glue formulated for conduit; rotate each newly glued connection 90 degrees to ensure a high-integrity bond that keeps out water and dirt.

If you do want to upgrade the system later, carefully pull the old wires or cables out of the conduit before installing new ones. Joe Cristino is an electrical engineer in Redding, Conn., who pays special attention to future-proofing when he designs power systems. He says he's seen plenty of wiring and communication cables damaged when homeowners or electricians ignore this basic rule of electrical construction. "Take your time," he says. "Do it once and do it right."

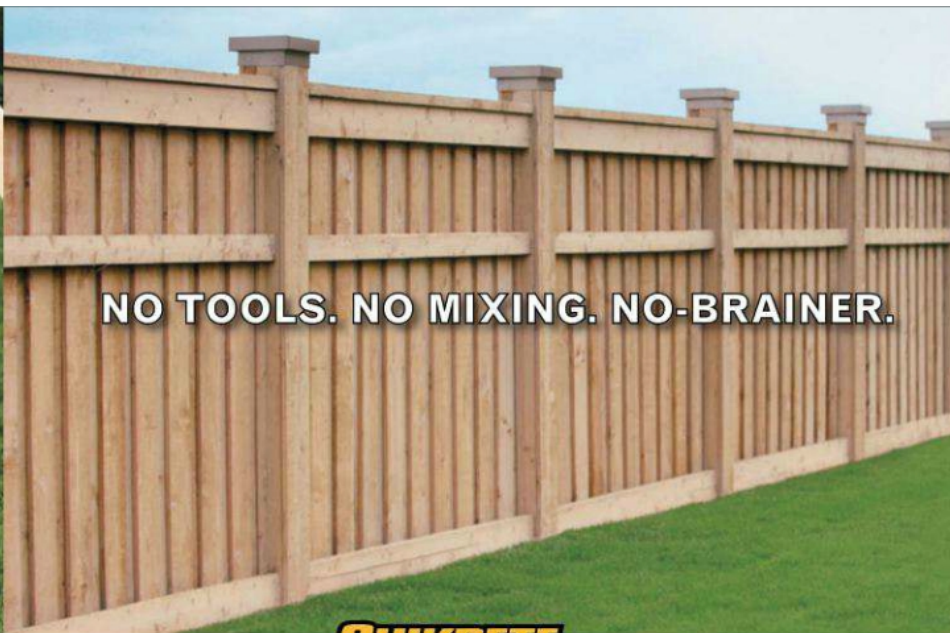
PM

**Got a home-maintenance or repair problem? Ask Roy about it.**

Send your questions to [pmhomeclinic@hearst.com](mailto:pmhomeclinic@hearst.com) or to Homeowners Clinic, Popular Mechanics, 300 W. 57th St., New York, NY 10019-5899. While we cannot answer questions individually, problems of general interest will be discussed in the column.







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*(circle applicable)*

As you know, (father's, my birth, because you love me, just another) day is right around the corner. I'd like to make shopping for me as easy on you as possible and avoid another (tie, golf accessory, monkey paw) which would ultimately end up (at the bottom of my closet, in a pond, unloved). Therefore, I have taken the liberty to provide you with this (foolproof, genius, best-gift-ever) suggestion, which will benefit us both greatly: I will get what I actually want; you will get a better version of me. Thank you in advance! ( \_\_\_\_\_ )

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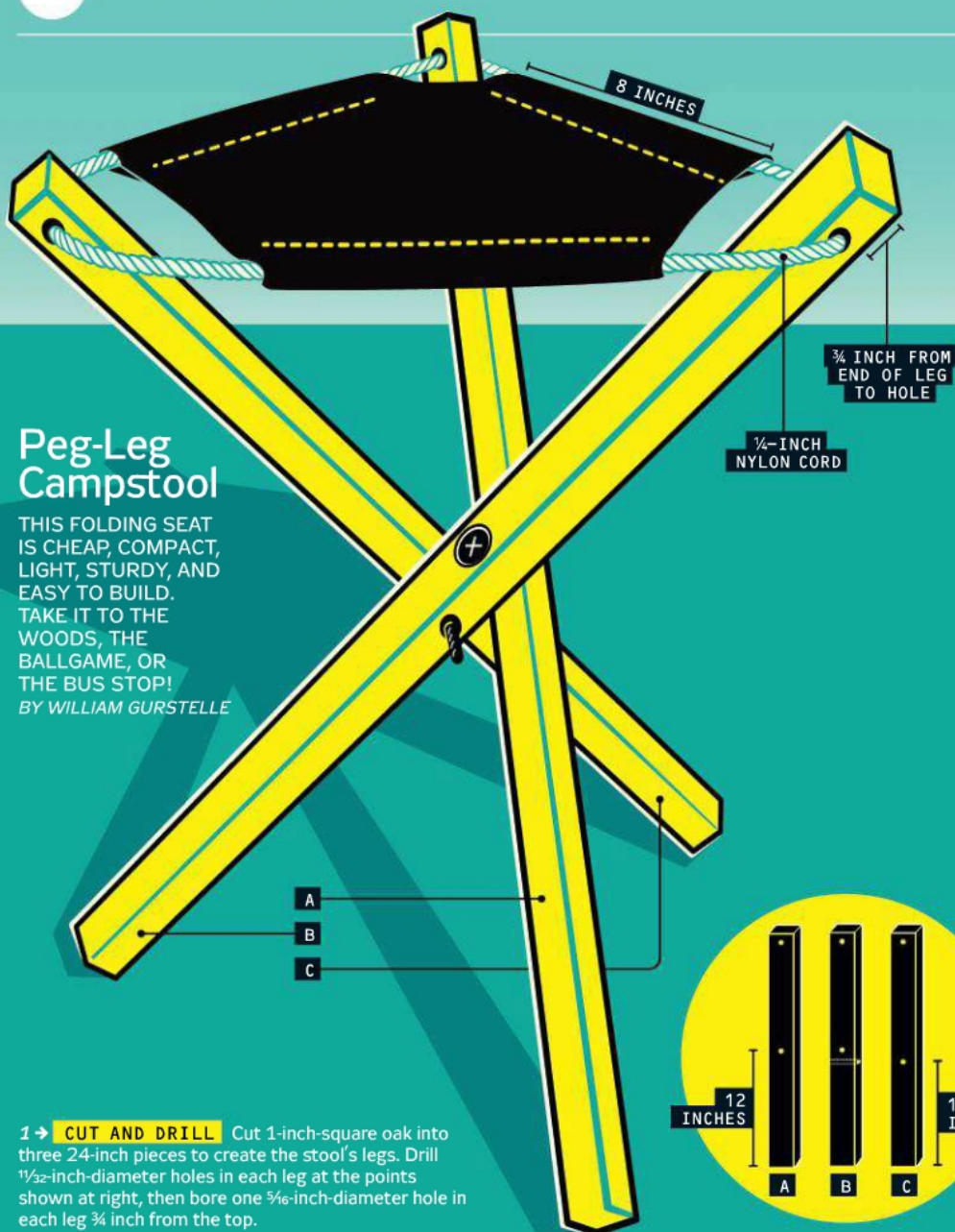
APRIL

**Cut a Deal on a Cruiser** → Visit the third annual Midwest Bicycle Swap, hosted by Wichita's Coasters Bicycle Club, at the Hometown Market in Haysville, Kan., on April 22. "Lots of vendors bring huge trailer loads of stuff to sell," event organizer Mitch Clothier says. Find parts and memorabilia for antique, street, mountain, and BMX bikes.

**Check the Car** → April is National Car Care Month, a good time to prepare your ride for hot weather. Inspect radiator hoses for cracks, and change or top off the oil, the coolant, and the brake and transmission fluids.

**See a Whole Lot of Hot Rods** → From April 26 to 29, 17 Texas antique-car clubs get together for the Pate Swap Meet at Fort Worth's Texas Motor Speedway. It's internationally known for its amazing array of engines, parts, and classic cars.

**Polish the Panes** → Use Andersen Windows' recipe for glass cleaner: Combine 1 cup white vinegar, 1 cup sudsy ammonia, and 1 gallon of hot water. Work from the top down, applying mix with a clean rag. Use a second rag to wipe on 1 gallon of hot water with 2 tablespoons of rubbing alcohol, then squeegee the pane.



## Peg-Leg Campstool

THIS FOLDING SEAT IS CHEAP, COMPACT, LIGHT, STURDY, AND EASY TO BUILD. TAKE IT TO THE WOODS, THE BALLGAME, OR THE BUS STOP!  
BY WILLIAM GURSTELLE

**1 → CUT AND DRILL** Cut 1-inch-square oak into three 24-inch pieces to create the stool's legs. Drill  $\frac{1}{32}$ -inch-diameter holes in each leg at the points shown at right, then bore one  $\frac{5}{16}$ -inch-diameter hole in each leg  $\frac{3}{4}$  inch from the top.

**2 → BOLT THE LEGS** Align the  $\frac{1}{32}$ -inch hole in leg A with the middle hole in leg B. Match the lower hole in leg B with the hole in leg C. Insert two  $\frac{1}{2}$ -inch-diameter,  $2\frac{1}{2}$ -inch-long bolts in the aligned holes. Add washers and nuts and tighten.

**3 → STITCH A SEAT** Make the seat by cutting an equilateral triangle with 12-inch sides out of heavy fabric, such as canvas. Hem the edges to prevent fraying. Fold the corners under so that the long sides measure 8 inches. Sew down the overlapping folded flaps with strong polyester thread, making three sleeves.

**4 → SPREAD AND THREAD** Push out legs to form a tripod. Each leg will bear upon another at 90 degrees, adding strength and rigidity to the structure. Holding the fabric seat in place, thread a  $\frac{1}{4}$ -inch-diameter nylon cord about 42 inches long through the upper holes and the sleeves in the fabric. Pull taut and tie off the ends with a square knot. Cut off any excess cord.

**5 → TAKE A LOAD OFF** Lower yourself onto the seat, steadying yourself for safety. When you're fully seated, you'll know the project is a success.



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# Auto

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A gallon of gas weighs 6.4 pounds, so we cross-checked our fuel economy using Longacre Racing scales.

## Testing the 40-MPG Claim

WE FIND OUT JUST HOW ACCURATE THOSE WINDOW-STICKER RATINGS ARE. BY BEN WOJDYLA

➔ **Gas prices remain stubbornly high**, and the economy is still lagging. Car-makers are responding to consumer demand for smaller, more efficient cars (and to stringent government fuel-economy standards) with a raft of vehicles claiming an astonishing 40-mpg highway rating. When a gallon of gas first topped \$4 in 2008, only the Toyota Prius and the Honda Civic Hybrid got over 40 mpg on the highway; now there are more than 20 cars able to achieve that kind of mileage. Over the past 12 months we've tested a variety of 40-mpg cars and have regu-

INSIDE

×

LEAKY SEALS + PLUCKING PLUMBING PARTS + SEASONALLY AFFECTED TIRES

PHOTOGRAPH BY BRIAN KELLY



larly missed hitting the window-sticker figures. Others have cried foul as well. Last December, a nonprofit group called Consumer Watchdog sent a letter to the Environmental Protection Agency suggesting that the Hyundai Elantra's rated fuel economy (29 city and 40 highway) was erroneously high. Perhaps, we wondered, the automakers had found a way to game the EPA's test. Then again, we're also keenly aware that driving behavior has a pronounced effect on fuel economy. So which is it? Are the cars overstating their efficiency, or are aggressive drivers like us distorting the results with our lead feet? We obtained a 2012 Hyundai Elantra and another 40-mpg car, the Ford Focus SFE, and did our own fuel-economy test. The results proved surprising.

## The Test

➔ **It's hard to replicate** the real world in a lab. But since 1975, the EPA has published test procedures that car-makers follow to determine the city and highway fuel-economy figures found on new-car window stickers (see "Behind the EPA Numbers," at right). Over the years, these tests—which are performed on dynamometers—and their corresponding calculations have been refined to better approximate real-world results. The latest update was in 2008, when the EPA included air-conditioning usage and its correction factors to bring down the window-sticker numbers.

For our testing, we specifically didn't want to replicate the way the EPA tests cars. This wasn't just for the sake of being contrarian but because we wanted to test the cars the way any reader might be able to, which meant driving the cars on the road. We were mainly after the highway-fuel-economy figure, but we also did a city-driving loop. The highway route took a nice big lap around the city of Detroit, twice. It was a lot of seat time but, at about 133 miles, a good distance to get a real-world average. We ran the highway test at both 55 mph and 70 mph, and to



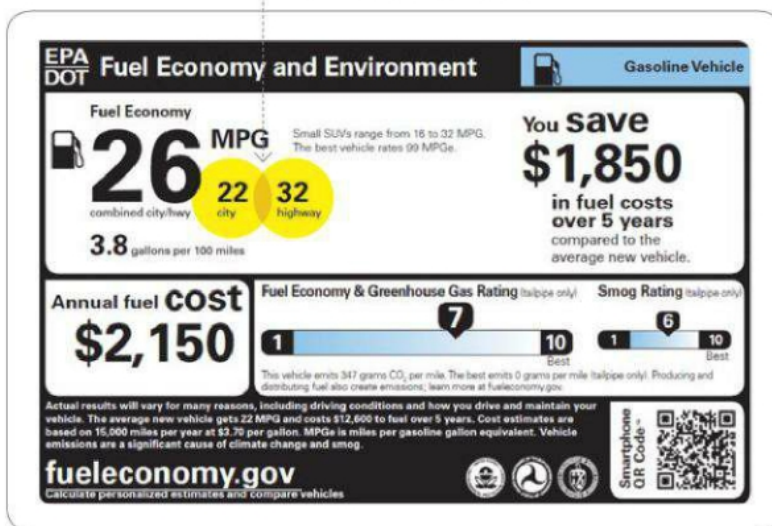
### STANDARDIZED TESTING

## BEHIND THE EPA NUMBERS

➔ Getting the window-sticker fuel-economy estimates starts with a car strapped on a dynamometer, which positions the car's drivewheels on a giant computer-controlled rolling pin. A technician operates the car following prescribed acceleration and speed curves. There are five different test procedures: city cycle, highway cycle, air conditioning on, high-speed driving, and cold starting for carbon monoxide emissions. All currently use

100 percent gasoline, something consumers generally can't buy because 10 percent ethanol mix is what most pumps dispense. Flow meters measure fuel consumed, and the exhaust gas is collected for emissions measurements. The tests are surprisingly slow and short—the longest is 11 miles, and the highest average speed is 48 mph. In this scenario, cars get much higher fuel economy than what's advertised to consumers. To adjust that

performance toward real-world figures, the EPA applies mathematical formulas to determine the **final numbers on the window sticker**. Further complicating matters is that for the Corporate Average Fuel Economy (CAFE), the government uses the uncorrected data. For the CAFE, our Elantra gets 56.5 mpg highway, but after correction the window sticker says 40 mpg. Complicated? We think so, too.



The EPA's new fuel-economy window sticker will roll out for model year 2013 vehicles.

avoid traffic variables, we drove in the middle of the day, when fewer cars were on the road. The city course was a meandering in-town 64.5-mile route up into the northern suburbs of Rochester Hills and back down along the riverfront, then up historic Woodward Avenue.

Accurately measuring the miles driven and the gallons consumed is tough. In-car odometers often don't match brand to brand, so we relied on the \$570 Performance-Box from Racelogic and its more accurate GPS-based distance measurement (we also used this to average our speed). Tracking the gallons used is similarly tricky. The procedure most people use is to top off the fuel tank at every gas stop and simply record the miles. According to Hyundai, however, variations in ambient conditions can result in one fill-up being as much as a half-gallon less than the next at the same pump. So to find out exactly how much fuel was used, we weighed the cars precisely



## DIY

## Auto TESTING THE 40-MPG CLAIM

before and after driving. Each gallon of standard E10 gasoline weighed in at 6.4 pounds, so if we drove 80 miles on the highway and the cars achieved 40 mpg, then they should be 12.8 pounds lighter than at the start—a simple but effective method.

## Results

➔ **Counter to our original** hypothesis, both cars demonstrated significantly better fuel economy than advertised. Cruising along at 55 mph on the highway, our cars easily cleared 40 mpg and, astonishingly, approached 50. At higher speeds, with greater aerodynamic drag, the cars were still very efficient. They didn't quite get 40 mpg, but they were close. City results were equally impressive, with each into the mid-30s. Bear in mind that we made no effort to be overly frugal—no drafting, no excessive coasting—and we made a point to keep up with traffic. Sure, we were a little light with the pedal, but slowpokes we were not.

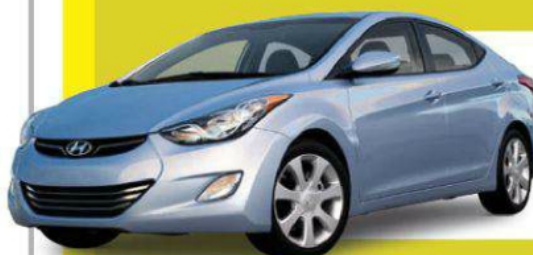
What, then, should we make of our own previous fuel-economy tests and the cries of Consumer Watchdog? To put it simply, your results will vary, and that is why the window-sticker figures are called estimates. For our test, we simply concentrated a little more on thrifty driving than usual, and it was 40 F outside, so we didn't use the air conditioning. There will never be a lab test that can cover all environmental variables or account for how differently we all drive. But these two cars demonstrate that with very little behavior modification, 40 mpg is quite a realistic figure. Not only is it easy to achieve, it's easy to surpass, even under less than ideal conditions. If you choose a car with a high-economy claim and drive within reason, you should be able to match those window-sticker figures. Considering that these cars are also decent performers on the road, the benefit of this high-efficiency engineering really goes to consumers, who are apparently getting more than they've bargained for. **PM**



### REALITY CHECK

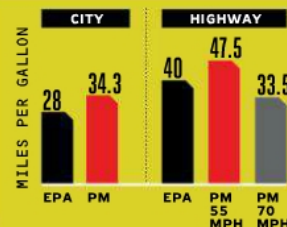
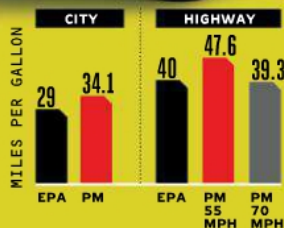
### PM MILEAGE TEST AT A GLANCE

WE TOOK TWO CLOSELY MATCHED, HIGH-MILEAGE VEHICLES ON MULTIPLE TEST LOOPS TO SEE IF THEY COULD HIT THEIR EPA WINDOW-STICKER NUMBERS ON REAL ROADS. WE FOUND THAT IF YOU'RE WILLING TO EASE THE PEDAL OFF THE METAL, THESE SIPPER OUTPERFORM THEIR RATINGS.



#### 2012 Hyundai Elantra

**WEIGHT AS TESTED**  
2781 pounds  
**ENGINE**  
1.8-liter inline four  
**HP/TORQUE**  
148 hp/131 lb-ft  
**TRANSMISSION**  
six-speed traditional automatic



#### 2012 Ford Focus SFE

**WEIGHT AS TESTED**  
2985 pounds  
**ENGINE**  
2.0-liter inline four  
**HP/TORQUE**  
160 hp/146 lb-ft  
**TRANSMISSION**  
six-speed dual-clutch automatic



**The Fuel-Economy Equation** ➔ Many factors determine efficiency—not the least of which is how aggressive you are on the throttle. Still, things like vehicle size, weight, and shape; road friction; outside temperature; aerodynamic drag; and losses in the powertrain all play important roles. Collectively, these factors are known as a vehicle's road load. We've created a simplified version of the road-load equation. Notice how velocity is squared in the equation, meaning each additional mph has a greater impact on your mpg.

$$\text{Road load} = \mu W + \frac{1}{2} \rho A C_d V^2 + m$$





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## Car Clinic

by Ben Wojdyla

**WEATHERSTRIPPING** keeps the inside in and the outside out. When these rubber seals go bad, your car will leak heat and air conditioning, as well as face assault from wind and rain.

**A** Into every life a little rain must fall, but it's best if it doesn't fall into your car. When weatherstripping—the rubber seals that keep water and air from infiltrating the cabin through the doors and the trunk lid—starts going bad, that rain eventually ends up on your seats, floorboards, carpet, and trunk. Sometimes when weatherstripping fails, you'll find a slow leak that can cause water accumulation—cars have been known to end up with a wading pool where passengers' feet should go. The good news is that identifying problem seals isn't very difficult and neither is replacing them, although it can be a bit expensive.

Finding a seal breakdown might take some detective work. Just because you find wet carpet in the rear passenger area doesn't mean the failure is in the rear passenger door—water has a funny way of sneaking around in a car. The wind noise you hear while driving is a good indication of the source of the leak; follow it to narrow your search. Inspect the seals around the doorframe and the perimeter of the door itself. Many times you'll find that the seals have cracked with age or that a hole has worn through from use. Sometimes the rubber will have lost its pliability and can no longer do its job. Check by squeezing it between your fingers; if it doesn't squish or spring back, it can't make a proper seal. If you're having a hard time pinpointing

## A Leaky Situation

I have a great 1984 Volkswagen GTI that I love dearly, but lately I've been noticing a lot of wind noise on the highway and water dripping down the inside of my windows when it rains. I suspect the weatherstripping is going bad. How can I tell, and if that's the problem, how do I replace it?

PHOTOGRAPH BY GREGG DELMAN



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the source of a leak, run water from a hose to find it.

Once you've found the problems, you have several ways to address them. Really enthusiastic owners will see bad weatherstripping in one part of the car as a sign that all of it is failing and will replace all the stripping as preventive maintenance. Frugal owners will fix just the problem areas, and that's fine too. Cheapskates will break out the silicone sealant or duct tape; this is not recommended.

Weatherstripping comes in two varieties: factory-replacement and generic. Generic can be a little sketchy and is best suited for a very old car or junker you won't be keeping long. If you want a proper fix, and judging by your pride in ownership, you do, factory-style replacement is the only way to go. Cross-shop your VW dealer against aftermarket retailers to find replacement parts you're comfortable with. Most of the time aftermarket replacements are just fine, but it's up to you. Before you start ripping stuff out of the car, though, compare new pieces with what you're replacing to make sure they're all the same size, with appropriate cross sections, holes, and joints.

If there are any screws holding the old pieces in place, take those out first and set them aside for reuse later. Peel away the stripping; be sure to remove the adhesive layer holding it on. You may need to use an adhesive remover to get it all. Next, wipe the weatherstripping channel and the new seals with a gentle cleanser and towel them dry; they may still retain a bit of mold-release agent. Apply a very thin bead of weatherstripping adhesive (available at auto parts stores) to the channel and install the seal lightly at first. Be sure everything is properly aligned, then press the



stripping firmly into place, ensuring good contact with the adhesive. Replace any screws and allow the adhesive to dry as directed. This should solve your whistles and wetness and prevent any undue carpet soggy in the future.

**Warning Woes** ➔ I have a 2006 Toyota Tundra, and every year around the beginning of winter, the Low Tire light shows up on my dash. I add air and bring the tires up to the recommended pressure, but the light remains on. Oddly, it shuts off in April or May. Can you tell me how to reset it?

With all tire-pressure monitoring systems, if your tires are correctly inflated the warning light should turn off on its own once the pressures are within spec. Before we go down the diagnostics road, we should probably eliminate the pressure gauge as the source of the problem. When temperatures turn colder, the volume of the air in the tires shrinks. It's fairly normal to have to fill your tires with additional air in the fall or the winter. The thing is, if the pressure gauge is reading wrong it could be telling you the tire is full when it isn't. It's probably worth a couple of bucks to get a new, high-quality, handheld gauge to make sure you really are filling the tires to the recommended pressure before you start blaming the car.

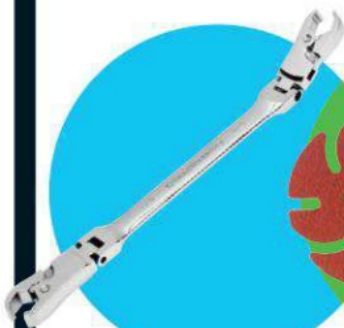
Now that you know your tires are correctly inflated, let's consider the other options. I've seen diagnostic systems stubbornly hold on to warning signals for no apparent reason. Go to a chain auto parts store (AutoZone, Murray's, Pep Boys) and ask to rent an OBD-II scanner. They'll charge your credit card, then credit the amount charged when you return the scanner. Plug the scanner into your OBD-II port in the driver-side footwell, then turn the key to the "on" position without starting the car. The machine will scan the car's codes, and you should get one in the



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format of C07XX, which is related to a tire-pressure-sensor fault. The scanner will give you the option to clear that code, which you should do. Then unplug the scanner, start the car, and see if the light stays out. If it doesn't, one of the in-wheel sensors may be malfunctioning. In this case, Toyota technicians will have to run a system diagnostic.

**Hardware-Store Parts** I changed both the crankcase and the transmission oil in my 2001 Harley Road King the other day, which requires new O-rings on the respective oil-pan plugs. After buying them from the cycle shop, it dawned on me that I might find cheaper replacements at my local hardware store. Sure enough, I found a 10-pack of what looks like exactly the same O-rings for much less. Will these withstand the heat generated from the engine?

This is always an interesting dilemma. The thrifty among us peer over to the hardware aisle and see visually similar components at a fraction of the price of factory parts and wonder if they'll work. The issue in using household bits in motorcycles or cars isn't just whether they'll hold up to heat, but if they'll endure repeated thermal cycling, chemical exposure, compression, and vibration in the way factory seals will. In all likelihood, the seals you spotted at the hardware store match the physical dimensions but not the chemical composition. Using those plumbing seals might work on your Road King for a while, but over time you may find an oily puddle under your bike, making you fit every Harley stereotype other bikers love to poke fun at.

**Good Catch** In the January 2012 DIY Auto section there appears to be some bad classroom chemistry. The article about using compressed natural gas for powering cars says methane combustion produces a molecule of carbon dioxide and four molecules of water when in fact it produces two. Here is the balanced chemical equation:  $\text{CH}_4 + 2 \text{O}_2 \rightarrow \text{CO}_2 + 2 \text{H}_2\text{O}$ . Having taught high school chemistry for many years, I hope that the article's author wasn't one of my former students.

You, and several other sharp-eyed readers, caught me. I enjoyed chemistry about as much as eating canned peas, though I'm sure had I been in your class things would've been different. The mistake was a bit ironic, since the correct equation means that natural gas is an even cleaner fuel than previously stated. My apologies to all the annoyed chemistry teachers out there.

PM

### Got a car problem?

Ask Ben about it. Send your questions to [pmautoclinic@hearst.com](mailto:pmautoclinic@hearst.com) or over Twitter at [twitter.com/PopMechAuto](https://twitter.com/PopMechAuto) or to Car Clinic, Popular Mechanics, 300 W. 57th St., New York, NY 10019-5899. While we cannot answer questions individually, problems of general interest will be discussed in the column.



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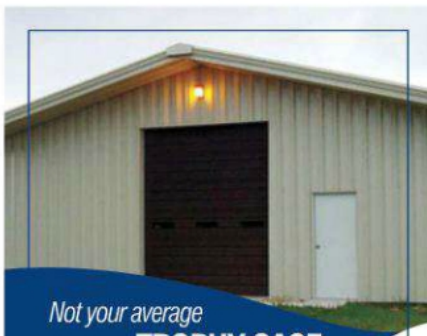
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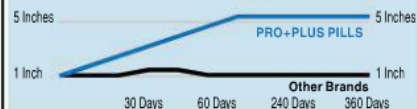
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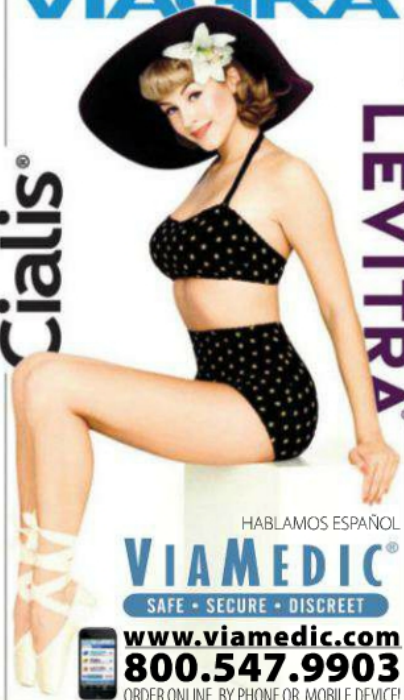
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## This Is My Job

### × ROBOTICIST

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Age: 25

Years on Job: 3

### PROJECTS

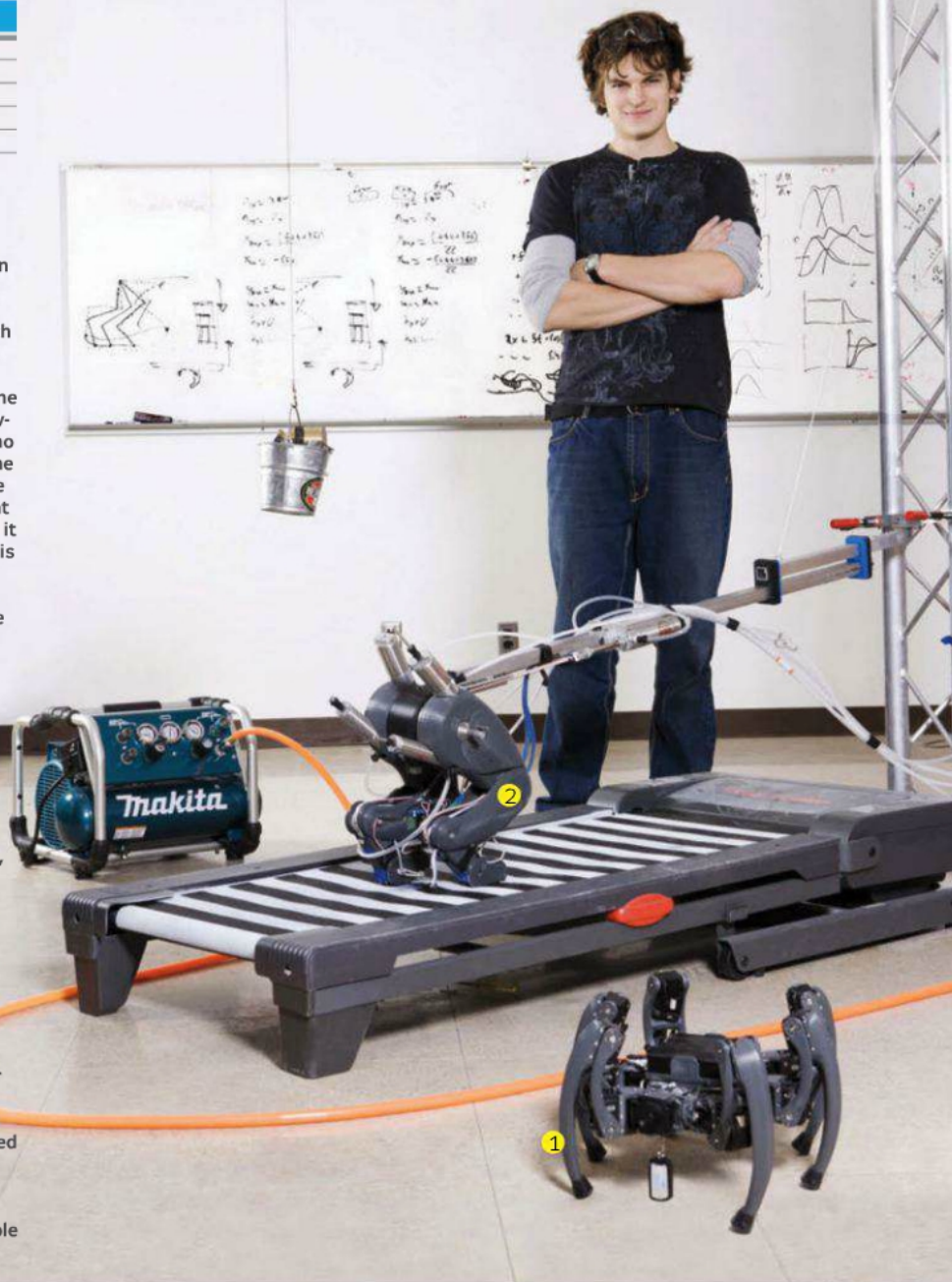
#### 1. HEXAPOD

When Bunting built this bot in 2009, it had no programmed knowledge of its own geometry. It used a camera to teach itself how to walk over four days. Now Bunting uses the device for research on machine learning. "I'm exploring behaviors using only the camera—no fancy sensors," he says. In one experiment, Bunting gave the robot a genetic algorithm that mimicked evolution, allowing it to learn how to walk with "this very eerie, natural motion," he says. "And that only took 10 seconds." For another, the hexapod built a 3D map of the surrounding terrain and stepped over obstacles.

#### 2. CHEETAH

To construct a robotic cheetah for a DARPA project, Bunting and his colleagues built a pair of pneumatically powered legs with simulated feet and toes. Most robots that run have springs in their feet. But the goal here isn't just speed. "If we wanted to build the fastest land robot, we'd make a wheeled machine," Bunting says. "Our constraint is to learn how biology solved a problem. It's hard to make a fully articulated limb that hits the ground all the time. It wears parts out." In the future, this work will help others make more durable robots and prosthetics.

× **When Matt Bunting was 12**, he began building robots—simple rovers driven by remote control. His parents were supportive of his hobby, but one member of the household wasn't so thrilled. "I'd make the rovers chase after my cat," Bunting says. "It would hide, so I had to make a robot to invade its privacy!" His robots became more sophisticated, and when he got to the University of Arizona, he built a hexapod with artificial intelligence. Bunting's professor offered him a job in the Robotics and Neural Systems Lab, where the 25-year-old now creates robots inspired by biology. "I knew that this was what I wanted to do, and now I'm doing it," he says. "It's incredible." — ERIN MCCARTHY





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